Oral presentations

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Sports psychology

1. THE USE OF PSYCHOLOGICAL INTERVENTIONS BY PROFESSIONAL COACHES

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The purpose of this study was to investigate the role of sport psychology in junior tennis and to determine whether coaches make use of psychological interventions, how important they consider these interventions to be, what kind of interventions they use and what problems they encounter in the process. Questionnaires were mailed to all professional coaches registered with Tennis South Africa. The results identified the most used interventions and the practical problems that these coaches encounter. The overall conclusion of this study was that sport psychology has an important role to play in junior sport.

2. THE EFFECT OF VERBAL ENCOURAGEMENT ON 6000 m TIME TRIAL PERFORMANCE IN PADDLERS

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Background: A common feature of most laboratory exercise tests is the use of encouragement, mostly in the form of verbal statements such as 'Keep going!'and 'Well done!' A few studies have investigated the effct of verbal encouragement on maximal exercise performance (i.e. VO_{2max}) and have found that, particularly in untrained subjects, there is a significant improvement in performance when verbal encouragement is included. However, the effect of encouragement has not been investigated in longer duration exercise tests, such as a time trial. **Methods:** 14 Paddlers (9 men and 5 women; age:22.2 ± SD 7.2 years) participated in this study. All subjects performed 2 time trials (6 000 m each) on a K1 Kayak Ergometer. During one test paddlers received verbal encouragement every 400 m and during the other test every 1000 m. The paddlers performed these tests in random order, 3 - 7 days apart. During both tests cardio-respiratory variables were measured using a Cosmed Quarkb² metabolic system, while ratings of perceived exertion (RPE) was obtained every 600 m using the Borg scale. **Results:** There was no significant difference in time trial performance between the 400m encouragement protocol and the 1000m encouragement protocol (30:18:09 vs 31:38:34, p = 0.23). There were also no significant differences in oxygen consumption, heart rate and RPE during the two trials. **Conclusion:** We conclude that during longer duration exercise tests, regular verbal encouragement do not affect performance in experienced paddlers. It seems therefore that regular verbal encouragement is more important during maximal exercise testing, than during a longer duration exercise test such as a time trial.

3. ALTERATIONS IN MOOD STATE FOLLOWING AN ULTRA-MARATHON

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Background: Anecdotal evidence suggests that an acute, intense exercise bout could result in post-exercise depression, specifically amongst endurance athletes. Aims: To monitor the alterations in mood state following an ultra-marathon. **Methods:** Experienced female (n=5) and male (n=9) athletes who participated in the Comrades Marathon completed the profile of mood state (POMS) questionnaire 1week pre-exercise (PE), 24hrs pre, immediately post exercise (IPE) then at 3, 24,48, 72 and 96hrs post exercise. **Results** were analyzed using a repeated measure ANOVA ($p<0.05$) Results: Surprisingly, no significant changes in depression were exhibited, however, significant changes ($p<0.05$) were found between PE and IPE vigour and fatigue, with fatigue being significantly elevated up until 3hrs post exercise. Interestingly, significant ($p<0.05$) changes were exhibited between PE and 3,24,48,72 and 96hr post exercise tension. **Conclusion:** Contrary to anecdotal evidence, the athletes did not exhibit depression after the Comrades marathon, although, tension of the athletes was significantly elevated up until 96hrs after the race. It is arguable that the manifestation of depression might have been a delayed reaction, thus future studies should monitor mood state for a longer duration following the exercise.

4. AN EVALUATION OF THE RELEVANCE OF THE KÜBLER-ROSS MODEL TO THE POST-INJURY RESPONSES OF COMPETITIVE ATHLETES

P. de V. Nel and J.H. van der Poel

Past attempts to explain and/or predict the post-injury responses of competitive athletes have often relied upon the use of current models of grief. The stage model of K¸bler-Ross (1969) has been particularly popular among sports psychologists and cited frequently in sports psychology literature. Since the model was based upon a very different subject population, its relevance to the post-injury responses of competitive athletes has been questioned. The study therefore purposed to evaluate the relevance of the model to the post-injury responses of competitive athletes. An existing database was utilized. The research sample consisted of 21 subjects who, as a result of injury, could not partake in sport for a minimum duration of two months. The sample represented various cultural groups, with ages ranging from 12 years to 35 years. Levels of participation ranged from provincial to international. Through a process of qualitative analysis, post-injury responses most similar to the grief responses proposed by K¸bler-Ross (1969) were identified and coded with the aid of the QSR NUD*IST computer program. Results indicated the frequent existence of post-injury responses similar to those proposed by K¸bler-Ross (1969), with the exception of responses of bargaining. The model also proved to be a relevant aid in the identification of several underlying tendencies occurring during the post-injury period. In terms of these results several further recommendations were also made.

5. "SLEDGING" — THE PRACTICE OF PSYCHOLOGICAL DISTRACTION IN CRICKET.

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"There is no crisis in cricket, just the next ball" (W. G. Grace)
The **aim** of this study was to examine the prevalence and impact of psychological distraction in cricket, known as 'sledging'. An outline survey of the history of cricket has shown that sledging is not a new strategy, yet it has become more dominant in the last 30 years. Cricket is a unique sport in that it may require batsmen to concentrate continuously for hours or even days. A loss of focus at the right moment may result in the termination of the player's innings. Therefore it is vital

that batsmen switch their concentration from a focal to a diffuse state and vice versa throughout their innings to avoid mental overload. Sledging by opposition fielders and bowlers is used as a psychological weapon to distract players. As there had been no previous study specifically addressing sledging, a questionnaire was designed and completed by 170 male cricketers of varying levels from Ireland, the United Kingdom, the West Indies, South Africa and Australia. The questionnaire surveyed umpires, players and coaches in order to gain general balanced opinions of sledging, its effectiveness on players and how they cope or fail to cope with it. The **results** of the survey confirm that sledging is common within most levels of cricket, with 96% of respondents having experienced sledging. Sledging culminated in detrimental performance for one in every two batsmen queried. In assessing the content of sledging itself 51% of respondents identified personal abuse as being frequently or always part of sledging, with 51% identifying a racist element either occasionally or frequently. Only 8% of respondents had never encountered racist abuse in sledging. The effect of sledging was deemed to be negative, positive or maintained depending on the perceptive and coping abilities of the player. A combination of theoretical models and anecdotal evidence supported the results by indicating why some players 'choke' in the response to sledging, and in-depth interviews with elite batsmen and support personnel indicated why good players can actually enjoy it. The study developed the relationship between anxiety, arousal, stress and performance in a specific sport situation. Jones' (1991) interaction model was used to highlight the psychological conditions taking place and propose the use of cognitive intervention strategies. Less than half the coaches surveyed had made use of cognitive intervention strategies, but all professional and international level players had used some form of cognitive coping strategy. There was a general perception amongst all respondents that the age group most negatively affected by sledging was 12 to 18 years. This implies that coaches and sports psychologists working at all levels should assist young players in developing their own coping strategies. The study has indicated that how players perceive and appraise sledging may determine its influence on their performance.

6. EFFECTIVE COMMUNICATION OF INJURIES BY MEDICAL PROFESSIONALS

P. de V. Nel and E. Oosthuizen

There is general concern about an increase in the incidence of sports injuries as participation in sport becomes more popular at all levels. The need for a holistic approach to the rehabilitation of sports injuries can enable sportsmen and women to recover from injury more rapidly. The purpose of this study was to investigate the relationship between the way in which medical professionals communicate details about sports injuries to sportsmen and women, and the attitudes of these sportsmen and women towards the subsequent treatment plan. The research group consisted of 20 injured sportsmen and women that had been participating in sport at provincial level at least. The research procedure made use of the process of triangulation to assess each of the 20 interviews individually in order to determine whether, in the opinion of the sportsman or woman concerned, the details of his/her injury were communicated to him/her in an effective manner. The injured sportsman's or sportswoman's attitude towards the treatment plan was determined in a similar way. Only 15% of the injured sportsmen and women were of the opinion that the doctor displayed empathy when communicating the details of their injuries to them. In contrast, 75% indicated that the medical professional did in fact communicate with them in a straightforward, clear and meaningful way. With regard to attitude, the majority of sportsmen and women (55%) experienced the treatment plan positively, while 45% experienced the treatment plan negatively. No significant relationship was found between the way in which details of injuries are communicated to sportsmen and women, and their attitude towards the subsequent treatment plan. A recommendation is made for the further investigation of the importance of non-verbal communication between medical professionals and sportsmen and -women.

Physiotherapy

7. PRE-SEASON HAMSTRING MUSCLE WEAKNESS, INFLEXIBILITY AND DECREASED FITNESS ARE NOT ASSOCIATED WITH INCREASED RISK OF HAMSTRING STRAINS IN CLUB RUGBY PLAYERS

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Objectives: Postulated risk factors associated with hamstring injuries in rugby players include decreased muscle strength, poor flexibility, decreased pre-season conditioning and not wearing thermal pants. The aim of this study was to determine which factors are associated with hamstring strains in club rugby players. **Methods:** A prospective cohort of 102 male club rugby players underwent preseason fitness testing, which included flexibility tests, isokinetic testing, body composition measurements, strength endurance, agility and cardiovascular fitness testing. During the 2001 season, hamstring injuries strains, defined as one preventing a player from participating in a training session or match were documented by clinical diagnosis in 9% of the players. Variables in the non-injured players (NI=91) were compared to the injured players (I=9), and within the I group the non-injured limb (NiL) was compared with the injured limb (iL). **Results:** A history of a previous hamstring injury was found to be the most significant risk factor for a hamstring injury (p=0.0001), resulting in a player with a past history being 8.23 times more likely to sustain a hamstring strain. There were no significant differences for strength endurance, agility, cardiovascular fitness or any of the isokinetic variables comparing the I group to the NI group (mean of the left and right leg). There was no significant difference in isokinetic variables comparing the iL and the NiL in the I group. However, concentric hamstring strength (Nm, mean+SD) was higher (p=0.044) in the iL compared to the NiL (iL=130±, NiL=119±) leg of the injured leg was significantly greater than the non-injured leg. The pain (VAS 0-10) with cervical flexion component of the slump test was reduced (I=2.7±3.0, NI=4.9+2.8) and range of motion (right leg passive straight leg raise test with ankle plantar flexion in degrees) was increased (I=92+22, NI=76+15, p=0.006) in the I group compared with the NI group. **Conclusion:** Other than a past history of a hamstring strain, conventional flexibility, strength and fitness measurements do not predict hamstring strains in rugby players. Other factors that are associated with hamstring strains must be considered.

8. THE EPIDEMIOLOGY OF ANTERIOR CRUCIATE LIGAMENT INJURIES IN FIRST DIVISION RUGBY PLAYERS IN DURBAN, KWAZULU NATAL

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Background: Previous studies have shown that rugby players frequently sustain anterior cruciate ligament (ACL) injuries. However, literature on the subject is limited. This study aimed to determine the incidence of ACL injuries amongst first division rugby players in Durban, KwaZulu Natal. **Methods:** Fifteen teams were included in the study. Each player completed a questionnaire (n=150) and the responses were analysed. **Results:** One hundred and thirty three players volunteered to participate in the study. The incidence of ACL injury was found to be most prevalent in four positions, namely, in centres, hookers, props and flanks. Biomechanical, neuromuscular and environmental factors were found to significantly influence ACL injury.

Conclusion: Various predisposing factors to ACL injury are related to specific positions in the game of rugby. Identification of potential risk factors for ACL injury in rugby players serves as a profile for diagnosis and treatment of ACL injury.

9. A COMPREHENSIVE REHABILITATION PROGRAMME FOLLOWING ACL RECONSTRUCTION - WHAT'S PRACTICAL AND WHAT WORKS

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Rehabilitation following ACL reconstruction remains one of the most contentious issues in sports medicine, with the merits of accelerated programmes versus the more conservative approach being constantly debated. In this paper, the current rehabilitation concepts will be discussed. These will include: -the goals of ACL surgery and rehab, the factors that influence rehab decisions, (surgical method, graft strength, graft remodelling, stressful movements), the importance of prehabilitation. A detailed programme will be presented which incorporates the early, intermediate and late phases of rehabilitation and the objectives for each. Emphasis will be placed on proprioception and agility exercises, with appropriate video clips - an area neglected by many therapists in the past.

10. THE ROLE OF BICEPS MYOFASCIITIS IN THE DIFFERENTIAL DIAGNOSIS OF VAGUE ANTERIOR SHOULDER PAIN OF MUSCULO-SKELETAL ORIGIN.

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Background: Myofascial trigger points (TrP's) generally have the ability to mask other, more severe pathologies, as well as the ability to complicate management by facilitating the development of satellite TrP's in their zone of pain referral. In the case of the Biceps muscle, biceps tendonitis may seem apparent, whilst TrP's develop in the Supraspinatus and Deltoid muscles. **Aim:** This study investigated the immediate and short term effectiveness of dry needling the primary, active Biceps TrP on pain experienced during shoulder forward flexion and abduction, as well as on associated bicipital tendonitis and satellite TrP's, in patients suffering from myofasciitis of the Biceps muscle. **Method:** Prospective, controlled pilot study. Volunteers were between the ages of 20 and 45 years and diagnosed with an active TrP in the Biceps muscle (n=30). The intervention was dry needling of the active Biceps TrP. Subjective data included the Numerical Rating Scale 101 (NRS 101) and the Shoulder Pain and Disability Index (SPADI). Objective data included range of motion (ROM) readings and a Myofascial Diagnostic Scale (MDS). Associated findings of satellite TrP's in the Supraspinatus and Deltoid muscles and bicipital tendonitis were also noted. **Results:** Immediate improvement in objective and subjective data was noted (p=0.000). Short-term improvement was significant for the MDS (p=0.019), NRS 101 (P=0.004) and the SPADI (p=0.000). ROM was significant at consults 1 and 3 (p=0.000). Associated satellite TrP's and tendon pathology prevalence also appeared reduced. **Conclusion:** Dry needling seems an effective intervention in the treatment of myofasciitis of the Biceps muscle for pain and functionality.

11. THE EFFECT OF SHOULDER GIRDLE AND TRUNK FLEXIBILITY EXERCISES AS WARM-UP COMPONENT ON KAYAK PERFORMANCE

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Background: The benefit of a single session stretching programme prior to a kayak sprinting performance is not well documented. **Aim:** To investigate the effect of a warm-up programme containing shoulder girdle and trunk mobility exercises on kayak ergometer performance. **Method:** In a single crossover study design, 20 healthy male students (18-24 years) were divided in a control group and an intervention group. They were untrained in kayaking but regular gymnasium attendees. Both groups did a warm-up consisting of 10 minutes of low intensity kayaking. An additional 10 minutes shoulder girdle and trunk flexibility programme was added to the intervention group. Range of motion measurements (ROM) of the trunk and shoulder girdle were taken pre-and post intervention. The warm-up for both groups were followed by the 4-minute supramaximal kayak ergometer test in which stroke force, power output and distance rowed were assessed. **Results:** No statistically significant change in shoulder girdle flexibility or trunk ROM was noted after warm-up for both groups ($p>0.05$). No statistically significant difference was found between the distances rowed after each warm-up ($p>0.05$), however, there was a significant improvement in the distance rowed on the subject's first attempt (test 1: 786.6±SD 14.23m) versus his second attempt (test 2: 807.1±SD 13.33m) ($p<0.05$). There was a statistically significant correlation ($p(0.05)$ between left trunk flexibility and left force generated in the intervention group after warm-up. There was no statistically significant difference between groups in muscle stiffness experienced after the sprint test at 24 and 48 hours after the test ($p>0.05$). **Conclusion:** A single session of stretching and mobility exercises included in a sport-specific warm-up regime preceding kayak sprints does not enhance subsequent performance of untrained kayaking individuals.

Nutrition

12. THE EFFECTS OF EPINEPHRINE ON SUBSTRATE METABOLISM AND RATINGS OF PERCEIVED EXERTION DURING MODERATE-INTENSITY EXERCISE

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The aim of this study was to elucidate the role of raised circulating epinephrine (Epi) levels, similar to that found during moderate intensity exercise, on intramuscular substrate utilisation, circulating substrate availability, and the rating of perceived exertion (RPE) during exercise in 11 moderately trained (VO_{2max}: 57 ml/kg/min) male subjects. In randomised order, separated by 7 d, 6 subjects cycled for 90 min at 68% of VO_{2max} with saline infusion or at 34% of VO_{2max} with Epi infusion. The remaining 5 subjects cycled twice at 34% of VO_{2max}, with Epi infusion or saline infusion. By 90 min, Epi infusion (0.015µg/kg/min) resulted in plasma [Epi] similar to that elicited during exercise at 68 % VO_{2max} (1.43 ± 0.46 vs. 1.15 ± 0.31 nM, respectively, P=0.30). In contrast, plasma [NorEpi] were significantly higher during exercise at 68 % VO_{2max} compared to Epi infusion at 34% of VO_{2max} (6.9 ± 1.6 vs. 2.5 ± 1.0 nM at 90 min, respectively, P=0.003). Intramuscular [triglyceride] decreased during exercise at 68 % VO_{2max}, but were not altered by Epi infusion at 34 % VO_{2max} (38.4 ± 13.9 to 29.8 15.7 vs. 36.8 ± 18.0 to 40.7 ± 24 (mol/g d.w., P=0.029). Plasma [glucose] increased from 4.4 (0.5 to 5.1 (0.7 mmol/l with Epi infusion, whereas plasma [glucose] remained relatively constant during exercise at 68 and 34 % VO_{2max} with saline infusion (~4.2 and ~4.4 mmol/l, respectively, P<0.05 for trial x time interaction). Similarly, Epi infusion increased plasma [lactate] significantly during exercise at 34 % VO_{2max} (~1.7 vs. ~1.1 mmol/l for Epi and saline infusions, respectively, P<0.001), although not to the same levels elicited at 68 % VO2max (~2.5 mmol/l, P=0.007). RER was not altered by Epi infusion (P=0.68), but was higher during exercise at 68 than 34 % VO_{2max} (P=0.003). Although RPE was significantly higher at 68 than 34 % VO2max (P<0.001), RPE during exercise at 34 % VO_{2max} with or without Epi infusion was similar (P=0.54). In conclusion, plasma [Epi] elicited by moderate intensity exercise increases the availability of plasma glucose and lac-

tate, but does not alter substrate utilisation or effort perception. These findings suggest that plasma [Epi] is dissociated from effort perception and substrate utilisation, and that changes in substrate utilisation with increasing exercise intensity may rather be mediated by plasma [Norepi].

13. DOES A MIXTURE OF B-SITOSTEROL AND B-SITOSTEROL GLUCOSIDE COUNTER THE EXERCISE-INDUCED IMMUNOSUPPRESSION IN CYCLISTS AFTER HIGH INTENSITY INTERVAL EXERCISE?

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Background: In several athletic disciplines periods of intense training have been associated with increased susceptibility to infection, which is probably related to the acute phase immune response and signs of inflammation that have been observed in laboratory studies. It has been shown that a mixture of plant sterols and sterolins decreases the imflammatory response in marathon athletes, and therefore their use to prevent the subtle immuno-suppression associated with high levels of physical stress, is justified. **Aim:** The aim of this study was to determine if this mixture of plant sterols and sterolins counters the immunosuppressive response in cyclists performing repeated bouts of high intensity cycle exercise. **Methods:** 18 Trained cyclists volunteered to participate in this double-blind, randomized controlled trial. The exercise test consisted of 2 x 30s all-out efforts, followed by 8 x 10 s all-out intervals. Each interval was followed by a 3 min recovery period. Four venous blood samples were drawn: at rest, and at 15 min, 2 hours and 24 hours after exercise. After baseline testing, subjects were randomly assigned to the experimental and control group. The interval test was repeated after 6 weeks in both groups. **Results:** The high intensity exercise test caused a significant leukocytosis and neutrophilia within 2 hours after exercise, which was only moderately inhibited by B-Sitosterol supplementation. The neutrophilia did not coincide with a change in neutrophil function. **Conclusion:** The time course of these changes and unresponsive neutrophil function may be indicative of the involvement of an integrated immune/endocrine response to high intensity exercise.

14. BONE MINERAL DENSITY AND DIET OF FEMALE ULTRA-MARATHON RUNNERS: A PRELIMINARY REPORT

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Background: Numerous reports have suggested that excessive exercise, and accompanying disordered eating and decreased oestrogen production, is linked with reduced BMD in female athletes. **Aim:** The aim of this preliminary study was to assess the BMD and diet of female runners preparing for the 2002 Comrades Marathon. **Methods:** The study group consisted of five athletes (age 31.6 years ± 2.8, body fat 19.74% ± 3.2, BMI 20.34 ± 1.8). The study was conducted 6 to 8 weeks prior to the Comrades marathon (weekly distance 66.7 km ± 15.4). A two-week dietary analysis was performed and a DEXA scan was used to measure the BMD (g/cm2) of the lumbar spine and hip. **Results:** The BMD of the athletes' lumbar spine and hip were 1.0946 g/cm2 and 1.0098 g/cm2 respectively. These values are above the normal value for females aged 30 - 35 years (spine 1.05 g/cm2, hip 0.95 g/cm2). The caloric, calcium and phosphorus intake of the athletes were normal compared to the recommended daily caloric intake for very active individuals, and the AI and RDA, for calcium and phosphorus respectively. **Conclusions:** The results suggest that weight-bearing activities such as running have a positive influence on bone health. The runners' bone density was above normal and diet was normal during preparation for an ultra-marathon.

15. THE EFFECT OF A SOY DRINK ON OXIDATIVE RESPONSE POST-EXERCISE

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Background. During oxidative phosphorylation electrons are shuttled through Complexes I-V to their final acceptor, oxygen to form ATP. **Aim.** To compare a soy-based post-exercise sports drink (soy drink) in terms of oxidative response to a control drink. **Methods.** 9 active males, in a cross-over study, consumed either 100 g of the soy or control drink, as well as followed a guided diet prior to and after a test day. On the test day either drinks were ingested (1 g carbohydrate.kg-1.serving-1) prior to, immediately following and 2 h after the first exercise protocol. Subjects completed 2 identical exercise protocols with concentric and eccentric components, separated by 6 hrs on the test day. Muscle biopsies were taken 2 wks prior to test day for baseline values (t=1), immediately following the second exercise protocol (t=2), and 22 h after the second exercise protocol (t=3). **Results.** No significant differences were found in Complexes between groups. However, Complex V activity of the soy drink group were higher at t=2 compared to the control drink group (1.18 vs. 0.88 (mole/min/UCS, P = 0.056). Furthermore, Complexes I+III, II, and II+III activities tended to be higher in the soy drink group at t=2. Within both groups complexes II+III and IV activities decreased from baseline to t=2, as well as complex V activity in the control drink group. **Conclusions.** A post-exercise soy drink may attenuate oxidative response and promote protection against free radical damage.

16. CONJUGATED LINOLEIC ACID (CLA) ADMINISTRATION: EFFECTS ON BODY COMPOSITION, SUBSTRATE UTILISATION, GLUCOSE AND LIPID METABOLISM AND METABOLIC RATE IN REGULARLY-EXERCISING INDIVIDUALS

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The aims of this study were i) to measure the effects of 12 wks of CLA administration on fuel utilisation at rest and during exercise, resting metabolic rate (RMR) and body composition and ii) to examine the effects of CLA on blood lipid profiles, glucose tolerance and insulin sensitivity in already exercising, normal weight persons. **Methods:** Sixty-four (25 men, 37 women, 2 withdrew) regularly exercising adults were randomised into 2 groups (CLA and CTL). All testing and analysis were conducted in a double blind, placebo controlled fashion. The active dose of CLA was 3.9 g/day (29.7% c9t11, 30.9% c10t12 isomers). Average pill compliance was 97%. Subjects underwent testing for cardiorespiratory fitness, and body composition assessment using skinfolds, DEXA and CT scans (a measure of regional fat). RMR, fuel utilisation at rest and during exercise were also measured. Oral glucose tolerance and insulin sensitivity were measured, along with blood lipid profiles. Subjects were re-tested at the end of 12 wks. **Results:** CLA was associated with a small but statistically significant decrease in body fat levels in women (27.5+3.2 to 26.6+3.0 vs. 28.8+3.7 to 28.6+4.3 %, CLA vs. CTL, P = 0.05), despite no changes in body mass or regional body fat distribution. There were no CLA-associated changes in body fat or regional body fat in men. Mean plasma [insulin] were also significantly lower (P<0.04) in women taking CLA (24.3+9.7 to 20.4+8.5 μU/ml) compared to CTL (23.7+9.8 to 26+8.8 μU/ml). Plasma glucose responses were not altered by CLA in men or women and insulin responses of men in both groups were similar. There were no significant CLA-associated changes in lipid profiles in

both groups in men or women. There were also no differences in RMR, fat oxidation or the activity of muscle enzyme, carnitine palmitoyl transferase (CPT) between treatment groups, men or women. Finally, CLA administration had no effects on diet composition, or on short-term satiety. **Conclusion:** Preliminary evidence suggests that CLA (3.9 g/day, 12 wks) has a gender-specific effect on body composition and insulin sensitivity, associated with a small but significant lowering of body fat levels and a reduction in mean plasma [insulin] during the OGTT in women.

Various

17. THE USE OF TISSUE ADHESIVES IN SPORT - A NEW APPLICATION IN INTERNATIONAL ICE HOCKEY

AS Branfield

18. POST ULTRA-MARATHON UPPER RESPIRATORY TRACT SYMPTOMS ARE NOT CAUSED BY AN INFECTION.

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Upper respiratory tract symptoms (URTS) after ultra-marathon races are attributed to infections. The purpose of this study was to identify whether known common pathogens are responsible for URTS post ultra-marathon. 104 runners were screened 2-4 days before a 56 km road race. Screening (Pre) involved a medical and allergy history, clinical examination, blood tests, skin allergy tests, nasal and pharangeal swabs (for viral and bacterial culture). Immediate post-race (Imm) blood samples were obtained from 102 runners. 2-10 Days post-race (Post) 35 runners (M=27, F=8) presenting with URT symptoms (S) were screened (history, examination, blood tests, swabs, and cultures), together with 33 asymptomatic (C) (M=27, F=6) runners matched for age, height, weight, gender, training and finishing time. There were no significant differences ($p<0.05$) between the groups in 1) Pre- or Post-race blood tests (Glucose, Comprehensive blood count parameters, C Reactive Protein, Serum IgA, Serum ASOT), and 2) prevalence of allergies. Immediate post-race blood glucose concentrations (mmole/L, mean (SD) in both groups were similar (S, 5.6 (1.2), C 5.1 (1.0)). Bacterial cultures post-race in the S group showed 1/35 scanty growth and 1/35 moderate growth (commensal), and in the C group 6/33 scanty growths (all commensals). No viral agents were cultured in any of the two groups either pre-, or post-race. The results of this study do not support the hypothesis that common bacterial or viral agents are responsible for the URTS post-race. Neither positive pre-race allergy skin tests nor immediate post-race hypoglycaemia was associated with post-race URTS in runners.

19. A COMPARISON OF FINDINGS IN CRICKETERS AND SOCCER PLAYERS INVESTIGATED FOR SPONDYLOLYSIS

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The repetitive cyclical loading of the pars interarticularis of the lumbar spine in athletes may lead to a stress fracture, known as a spondylolysis. A stress response in the bone may be apparent on Single Photon Emission Computerised Tomography (SPECT) scan and reverse gantry Computerised Tomography (rg-CT) will characterise the bony architecture of the pars interarticularis and hence identify fractures. The causes of spondylolysis in fast bowlers in cricket have been and studied and are thought to relate to technique and overuse. Soccer, our national game, is also popular in England and in our experience is associated with spondylolysis. The biomechanics of cricket and soccer are very different and we speculated that the site of spondylolyses in the lumbar spine might vary between these two sports as a consequence. SPECT and rg-CT findings of 42 cricketers and 28 soccer players presenting with activity related low back pain at the Centre for Sports Medicine and Spinal Unit at Queens' Medical Centre, Nottingham, U.K. were compared. The median age of the cricketers was 19.7 (13.0 to 29.9) years, and of the soccer players was 17.5 (11.5 to 44.0) years. Most were playing sport professionally or at a high standard and were intending to become professional. Only two of the cricketers were known not to be bowlers and of the bowlers there was only one was a spin bowler. Two fast bowlers were known to be left arm bowlers. Thirty-seven (90.4%) of 42 cricketers and 23 (82.1%) of 28 soccer players studied had increase in scintigraphic uptake detected on SPECT. Increased scintigraphic uptake was found on the left of the neural arch of 49 lumbar vertebrae of cricketers and on the right of 33. In soccer players there was a significantly different proportion with 17 sites on the left and 28 on the right (difference = 22.0% [95%CI = 0.04 to 0.38]). Lower lumbar levels showed increased scintigraphic uptake more often than higher levels, though the trend was reversed at L3 and L4 in soccer. Forty spondylolyses were identified in the lumbar vertebrae of the cricketers and 35 spondylolyses were identified in the soccer players. These comprised 26 complete to 14 incomplete fractures in the cricketers and 25 complete to 10 incomplete fractures in the soccer players. Similar numbers of incomplete fractures were found either side of the neural arch in soccer players (5), but more left sided pars had incomplete fractures (14 to 2) in cricketers. The proportion of incomplete fractures either side of the neural arch was significantly different between cricket players and soccer players (difference = 37.5% [95%CI = 0.02 to 0.65]). Most complete fractures were at L5 (66.7%) and more were found at L3 (15.7%) than L4 (6.9%), however incomplete fractures were more evenly spread though the lower three lumbar levels with 41.7% at L5, 37.5% at L4 and 20.8% at L3. Fast bowling in cricket is associated with pars interarticularis bone stress response and development of incomplete stress fractures more often on the left than the right. Playing soccer is associated with a more symmetrical distribution of bone stress response, including stress fracturing. Within cricketers unilateral spondylolyses tend to arise on the contralateral side to the bowling arm. We suggest that these findings are explained by the repetitive spinal movements of fast bowling that contribute to propulsion of a ball from the same hand and in one direction relative to the trunk, whilst a variety of spinal movements contribute to kicking a football in various directions and with either foot in soccer, though players often favour one foot. More research is required to understand how the techniques of each sport lead to these injuries.

20. INCIDENCE, OCCURRENCE AND PREVENTION OF LOWER LIMB STRESS FRACTURE IN FAST BOWLERS IN PAKISTAN

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This abstract is a study of two year on incidence of lower limb stress fracture in Pakistani Fast Bowlers attending National and Regional Cricket Academies during session 2001 and 2002. 150 players attended National / Regional Cricket Academies during session May - August, 2001 and among them 50 players constituted fast and medium fast bowlers. During the period it revealed that 10 fast bowlers had definite evidence of stress fracture which was confirmed on bone scan (Incidentally, few of them were subjected to MRI scan before the bone scan and all of them returned negative with no evidence of bone pathology). It resulted in 20% of fast bowlers being sidelined with injury. It was interesting to note that the Right Arm Bowlers had Stress Fracture in the Left Lower Leg and Ankle Region and Left Arm Fast Bowlers in the Right Leg, there was no reported case of stress fracture in the back and only one fast bowler had stress fracture in the 11th Rib. The players were subjected to undergo a Rehabilitation Program under the

guidance of Pakistan Cricket Board Doctor's Medical Panel, almost all of them responded to the program and returned to the first class season which started from September, 2001 (only one player had recurrence of injury but on the other leg). Taking into account such a large numbers of injuries in young fast bowlers in Pakistan it was suggested to find causes of such high incidence. One reason attributed to the incidence was probably hard grounds (4 cases reported at Sheikhupura Regional Academy in Punjab province). Another origin was "too much training too soon" or bad bowling technique resulting in this overuse stress injury. Another explanation was lack of proper diet in these growing athletes. Lastly, an opinion was given regarding the body types found in northern parts of Pakistan which may have contributed to such injuries. After going in details regarding the possible risk factors an educational program was devised for the coaches of the academies to gradually load training of these fast bowlers, the coaches used video technology to see and correct the fast bowler's techniques. The Pakistan Cricket Board in the meantime invested heavily on infrastructure in development of new softer ground and practice pitches with good run-up for the fast bowlers on new grass. A Physical Trainer imparted training to the academy players based on scientific principles of training with gradual loading, strength, endurance, stretching and flexibility exercises. Sports Nutritionist gave specialized diet plans for the players with high emphasis on calcium and milk in the diet program. A player's education and awareness program was launched during the session of 2002 for Regional Cricket Academies in Pakistan. These players were asked to maintain a diary or log book on day to day basis and it was checked and countersigned by the concerned coaches or Sports Physicians, by maintaining this log book. It was observed that the number of injuries dropped during the session May to August, 2002 (from 120 players, 40 fast and medium bowlers - 3 reported injuries).

21. THE EFFECT OF PARTICIPATION IN A "CRICKET FOR LIFE" PROGRAMME ON THE SKILL DEVELOPMENT SPORT ORIENTATION OF PRIMARY SCHOOL BOYS.

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This study was focused on exploring the potential of the sport experience - specifically cricket - to make a contribution to the development of the motor skills and attitude toward competition of primary school boys. The approach to coaching cricket used in this study was defined by Paterson (1987) as the Cricket-for-Life programme, since it involves the use of 10 specific coaching strategies while helping players improve their skills for cricket. This approach may be regarded as an educational approach to teaching/coaching cricket. Boys between the ages of 10-12 were invited to participate in a seven-week, two sessions per week cricket programme. An experimental and a control group were established at each school through a process of random selection. Boys in the experimental group received the Cricket-for-Life approach and boys in the control group received a traditional cricket skills development programme. All boys were pre- and post-tested for skill performance and on their attitudes toward competition (Gill & Deeter, 1988). **Results** indicated that there were significant changes in the skilld of the boys in both the experimental group (n= 40) or the control group (n=42). Boys in the experimental group also demonstrated a significant change in their orientation toward sport competition. The attitude toward sport by the boys receiving the Cricket-for-Life approach became significantly less orientated toward winning. The results of this study must be considered in light of the objectives for primary school cricket. A programme conducted with educational objectives can have different outcomes than a programme aimed only at skill development. This may have an impact on the role of primary school cricket in the long-term development plan for top-level cricket.

22. THE EFFECT OF JET THERAPY ON SKELETAL MUSCLE FIBRE AND CAPILLARY DIAMETERS.

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Jet Therapy is a new treatment modality advocated for treating muscle injuries. Treatment involves massage with compressed air. Jet Therapy has been shown to increase skin blood flow as measured with laser Doppler fluxmetry, while at the same time lowering skin temperature. The reduction in skin temperature would be expected to produce reflex vasoconstriction and a reduction in blood flow. **Aim:** To measure the effect of Jet Therapy on rabbit skeletal muscle capillary and muscle fibre diameter. **Methods:** 16 New Zealand white rabbits were studied. All animals were anaesthetised, the fur of the left thigh removed with a depilatory and the lateral thigh treated for 10 minutes with the Sports applicator head using 1 atmos air pressure. Muscle biopsies were taken from the treated vastus lateralis within 10 minutes of treatment (n=4), 24 hr after treatment (n=4) and 6 days after treatment (n=4). Biopsies were taken from the right vastus lateralis of each animal as a control. Four control animals were not treated and biopsies were taken from their left and right vasti lateralis. All biopsies were bisected, one being prepared for histology, with 4(m wax sections stained with haematoxylin and eosin for myofibre morphometry, the other being embedded in resin with 1(m sections stained with toluidine blue for capillary morphometry. Using computerised image analysis, a minimum of 125 muscle fibres and 75 capillaries were measured from each biopsy. **Results:** Treatment caused significant changes in fibre diameter (ANOVA, $p<0.0001$). Treated fibres were significantly larger than the untreated fibres immediately after treatment ($p<0.001$) and 24 hours after treatment ($p<0.01$). 6 days after treatment the treated fibres were significantly smaller than the untreated ($p<0.01$). In untreated controls there was no difference in the fibre diameters of the right and left vasti. Treatment caused an average increase in capillary diameter and cross sectional area immediately after (16.4%) and 24 hours after treatment (23.9%) ($p<0.001$). 6 days after treatment there was no difference in capillary diameter. **Conclusions:** Treatment with Jet Therapy results in a significant increase in the average diameter of skeletal muscle capillaries suggesting an improvement of muscle blood flow lasting at least 24 hr. The changes in muscle fibre diameter may be evidence of barotrauma. These data support the previous observations of increased skin blood flow during treatment.

23. DO KNEES SURVIVE THE COMRADES MARATHON? AN MRI STUDY

G Hageman

Aim: The aim of the study was to determine the effects on the knees of runners who completed the Comrades Marathon, as evident from magnetic resonance imaging. Specifically, the presence of bone bruising caused by running the equivalent of more than 2 marathons was looked for. **Method:** Ten runners volunteered to have one knee scanned 48 hours prior to, 48 hours subsequent to, and 4 weeks post the Comrades Marathon. The knee to be scanned was randomly selected. **Findings:** All knees scanned showed an increased volume of joint fluid both pre and post completion of the ultramarathon. Old injuries such as ACL, MCL, meniscal and soleus tears, and chronic abnormalities such as Baker's cysts, do not appear to be effected by the race. Typical overuse injuries (such as tendinoses) appear to be worse immediately after the race, but as a general rule have subsided a month later. No bone bruising was evident in any of the knees scanned. **Conclusion:** Bone bruising does not appear to occur in the knees of runners competing in the Comrades Marathon. The race only appears to have detrimental effects on those runners starting the race with an overuse injury, which is subsequently aggravated.

Biokinetics

24. THE RELIABILITY OF RUNNING STYLE DESCRIPTIVE BIOMECHANICAL VARIABLES MEASUREMENT AT SELF-SELECTED RUNNING SPEEDS

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Objectives: The aim of the study was to determine the repeatability of the biomechanical variables (BV) descriptive of running style at self-selected running speeds (SS) during test sessions on two successive days (component one [C1]) and during two test sessions within a single day (component two [C2]). **Methods:** Uninjured recreational runners (RR) (n=17) (32.2±9.8 years; 70.08±10.98 kg; 1.73±0.08m) were recruited to evaluate the selected temporal distance (TD), kinetic (Kn), kinematic (Km), and mechanical power and work (PW) BV with the 370 Oxford Metric Vicon Motion Analysis system. The runners were randomly allocated to C1 (n=10) and C2 (n=7). **Results:** The C1 Day2 SS trials were greater (3.9±0.5 m/s) than Day1 (3.8±0.5 m/s) (p=.031). The SS of the C2 trials were identical (2.8(0.4 m/s). In C1, the r-values for TD, Kn, Km and PW ranged from r=.75 (p=.012) to .95 (p=.000). In C2, the r-values for TD, Kn, Km and PW ranged from r=.81 (p=.027) to .99 (p=.000). Vertical impact force at peak value (VIF) and at 25ms of stance (VIF25) were greater on the second day (VIF: 1.58±.28; VIF25: 1.58±.28 BW) compared with the first day (VIF: 1.45±.26; VIF25 1.45±.27 BW) (p<0.05). The knee angle in stance (Kst), ankle angle in terminal swing (Asw) and ankle at initial contact (Aic) were different on Day2 (Kst: 39.8±4.0°, Asw: -5.5±7.2°, Aic: -3.8±7.0°) compared with Day1 (Kst: 38.5±3.3°, Asw: -9.2±5.3°, Aic: -6.4±5.3°) (p<0.05). The concentric ankle work (Caw) was greater on Day1 (.43±.15 J/kg) than Day2 (.38±.14 J/kg) (p=.014). There were no differences in any of the BV measured in the two sessions of C2. **Conclusions:** This study demonstrates that the biomechanical variables commonly used to describe running style might reliably be determined in RR at SS in protocols that do not extend beyond a single day. Differences in SS appear likely to influence the results of running style BV. Careful consideration should be given to the use of SS in running style biomechanical evaluations, if BV are compared in the same RR on more than one day, as there may be differences in SS and consequently in the BV studied.

25. A COMPARISON OF A HOME- VERSUS A GYMNASIUM-BASED REMEDIAL EXERCISE PROGRAM FOR 45-50 YEAR OLD WOMEN WITH CHRONIC LOW BACK PAIN (LBP)

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Background: Chronic LBP is disabling to individuals and represents a substantial financial burden to industrialized societies. The frequency of chronic LBP increases with age and is more prevalent in females. **Aim:** To compare a gymnasium - versus a home- based remedial exercise program for LBP sufferers. **Methods:** 80 women with chronic LBP pain were randomly assigned to a gymnasium (GG) (weight training) and home-based (HG) free standing remedial exercise programs for 3 months. The following was assessed pre- and post 3 months exercise: pain (6-point scale), strength (upper body, lower back and abdominals) and flexibility (hamstring and quadriceps). Results were analyzed using independent t-tests. **Results:** Both groups showed a significant increase in strength (GG = 78%, HG = 54%) and a significant improvement in flexibility (GG= 56%, HG = 40%). Importantly, both showed a reduction in pain scores (GG= -76%, HG= - 63%). **Conclusion:** Both programs reduced the intensity of LBP, with the GG showing the greatest improvement.

26. INFLUENCE OF HAND AND FOREARM IMMERSION IN COLD WATER ON GRIP STRENGTH, MANIPULATIVE CONTROL AND PSYCHOPHYSICAL RESPONSES.

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This study investigated the effects of hand and forearm immersion in 2°C water for one minute on grip strength, manipulative control and physchophysical perceptual responses. Grip strength was measured using a Takei hand grip dynamometer while manipulative ability was assessed by observation of the time taken to compete a required task. On completion of each task the subjects were required to give perceived pain responses. These tests were administer before and directly after immersion. Paired *t*-tests and Pearson's product-moment correlations were used for statistical analysis. The forearm immersion resulted in a significant decrease in grip strength and a significant increase in manipulation time, 44% and 37.9% respectively. In addition perceived pain responses were significantly higher after immersion than before. These findings are valuable to all ergonomic and sporting situations which require the worker or the elite sportspersons to perform and achieve high levels of competence in extreme exposure conditions.

27. PHYSIOLOGICAL PROFILES OF SOUTH AFRICAN AND PROVINCIAL JUNIOR SPRINT KAYAKERS

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Background: Minimal data is available concerning the physiological profiles of junior sprint kayakers. **Purpose:** The aim of this study was to investigate the physiological characteristics unique to elite South African (SA) junior sprint kayakers. **Methods:** Fifteen Gauteng squad members (8 SA, and 7 Provincial (Pr)), were recruited. Anthropometric characteristics, isokinetic shoulder, strength (external/internal rotation; flexion/extension at 60∞/s), maximal heart rate (MHR) and VO_2 peak were determined. Student's t-tests were performed for comparison. **Results:** Significant differences were found between MHR (p = 0.022) and relative VO2peak (p < 0023), Mean values for MHR were SA = 193 b/min (± 5.73), Pr = 185 b/min (± 5.47) and for VO2 peak SA = 62.2 ml/kg/min (± 4.89), Pr = 52.3 ml/kg/min (± 5.19). The mean external/internal rotation ratio for SA and PR was 0.72 (normal = 0.79), and the flexion/extension ratios were SA = 0.76 and Pr = 0.82 (normal = 0.94). **Conclusions:** The study presents physiological data unique to elite junior. South African sprint kayakers. MHR and VO2 peak were significantly higher in the SA versus the Pr kayakers. The MHR and VO2 peak differences could be attributed to numerous, factors including genetics, superior training methods, |or kayaking technique. The strength data indicates the need for individualized strength training programmes to help restore dynamic joint stability in both groups.

28. OBESITY, BLOOD PRESSURE AND PHYSICAL ACTIVITY AMONG 10 - 15 YEAR OLD CHILDREN : THUSA BANA STUDY

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Aim: The primary purpose of this study was to investigate the relationship between blood pressure and measures of obesity in 10 - 15 year old children in the Northwest Province of South Africa. The secondary aim was to determine the influence of physical activity on the possible relationship between blood pressure and obesity. **Method:** A one-time cross sectional experimental design was used for this study. A total of 605, 10 - 15 year old males and 640 females were recruited from 44 randomly selected schools in the North-West Province, which formed part of the THUSA BANA study during 2000 and 2001. Demographic data and physical activity participation data were obtained through standarised questionnaires. Anthropometric measurements selected to determine percentage body fat, were primarily those described in Norton and Olds (1996). Blood pressure was measured with the Finapres in a non-invasive way. Data analysis was performed using Statistica 2000 (Stat Soft., Inc) for Windows 1998. One-way (ANOVA) and two-way analysis of variances together with Tukey post hoc HSD tests were used to indicate the differences between variables. The level of significance was set at $p<0.05$. **Results and conclusions:** Percentage body fat was not significantly associated with blood pressure for both males and females in analysis of variance. Although there were no statistically significant differences between percentage body fat and blood pressure, there seemed to be a trend that for systolic and diastolic blood pressure to increase with an increase in percentage body fat, both in the male and female groups. Two-way analysis of variance showed that physical activity had no significant effect on the relationship between percentage body fat and blood pressure.

29. DO RUNNERS NATURALLY ADOPT THE RUNNING STYLE THAT IS ASSOCIATED WITH THE LOWEST ECCENTRIC LOAD OF THE KNEE?

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Background: It is generally accepted that running style is a learned response, and that a runner naturally adopt a running style that will result in the lowest mechanical stress on the musculoskeletal tissues of the lower limb. **Objective:** The aim of this study was to determine lower limb biomechanical variables in runners with a natural heel-toe running style who are coached to modify their running style. **Methods:** Twenty (20) natural heel-toe (HT) runners were instructed (4 hrs per week for 1 week) in running on the forefoot (FF) and a novel method (NM) running style. The NM of running style is characterized by a vertical alignment of the shoulders and hips with the support leg, while standing on the ball of the foot. The runner then changes the pose from one leg to the other by falling forward and allowing gravity to do the work. Gait analysis was performed on the group during running at their preferred speed using the Oxford metric Vicon Motion Analysis System and the Helen Hayes modified marker set. The biomechanical variables compared for the groups across the 3 running styles were: stride length (m), contact time (s), vertical oscillation of the sacrum and heel (m), loading rate (N/s) and knee eccentric work (Joules/kg). **Results:** The NM running method was characterized by significantly ($p<0.05$) shorter stride length (m) (HT: 2.20(0.56, FF: 2.17(0.71, NM: 1.48(1.04), decreased contact time (s) (HT: 0.27(0.03, FF: 0.26(0.03, NM: 0.25(0.03), decreased heel (HT: 0.38(0.11, FF: 0.36(0.14, NM: 0.28(0.21) and sacral vertical oscillations (m) (HT: 0.09(0.03, FF: 0.08(0.03, NM: 0.05(0.04), and reduced knee eccentric load (J/kg) (HT: 0.47(0.15 J/kg, FF: 0.47(0.15, NM: 0.16(0.08). **CONCLUSION:** Runners that naturally adopt heel-toe running can alter their running style by training to adopt a novel style that significant alters biomechanical variables that could result in a reduced risk of running injury and improve running economy.

30. THE PRESENCE AND EXTENT OF QUADRICEPS FEMORIS WEAKNESS IN INDIVIDUALS WITH PATELLOFEMORAL PAIN SYNDROME (PFPS).

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Background: Numerous studies have been conducted attempting to determine the presence and the role of Quadriceps Femoris (QF) weakness in PFPS. Research up to this point has been inconclusive. Developments in Isokinetic Dynamometry has made it possible to isolate extensor muscle groups and determine the presence and extent of weakness. Evidence suggests that this type of measurement holds promise as a direct indicator of functional status. Consequently, the QF weakness theory could be rigorously evaluated. **Aim:** The aim of the investigation was to evaluate: 1.Quadriceps torque at 60 degrees/sec relative to patient's body weight, 2.Torque acceleration energy (TAE), 3. Average Power, 4.Total work of the quadriceps, 5.Eccentric hamstring/ concentric quadriceps ratio. as indicators of weakness in subjects with PFPS. **Method:** A quasi- experimental pilot study. The study was limited to subjects suffering from PFPS. Suitable subjects underwent a full Case History, relevant Physical and Knee Regional examination. Informed consent was attained from all subjects.Subjects suffering were evaluated using standardized Isokinetic testing protocol on a Cybex 700 Dynamometer. A pre-test was undertaken by each subject one week prior to the actual test in order to enable subjects to become familiar with the machinery. Values from the actual test were then compared to established and accepted normative values attained on similar machinery. Data was analyzed through the use of the SPSS statistical package. Inter-group comparisons were drawn using the one sample t-test. **Results and Conclusion:** The study is approximately five weeks from completion after which the results and conclusion will be added.

31. RELATIONSHIP BETWEEN RUNNING STYLE DESCRIPTIVE BIOMECHANICAL VARIABLES AND SELF-SELECTED RUNNING SPEED, FOOT-TYPE AND AGE

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Objectives: Self-selected running speed (SS), foot-type (FT) and age have an effect on the running biomechanical variables (BV) in small samples of runners under controlled laboratory conditions. It is not known what the changes in BV are in a large running population at SS, where there is variation in FT and age. The aim of this study is to determine the relationship between the BV and SS, FT and age. **Methods:** Recreational runners (n=60) (75.71(13.07, [49-115] kg; 1.76(0.09, [1.54-2.01] m; 34.88(13.08, [18-70] years) with neutral (n=35), pronated (n=21) and supinated (n=4) FT were recruited. Data was collected with the Vicon 3D Motion Analysis System (3.1(0.5 m/s, [range 2.2-4.8 m/s]). **Results:** Age and SS were determined independent variables for BV normalised for body mass. FT did not have a relationship with any BV. The horizontal braking ($r=.677$, $p=.000$) and propulsive

(r=.694, p=.000) forces, vertical impact force peak magnitude (r=.423, p=.000) and its loading rate (r=.386, p=.002), and the vertical propulsive force peak (r=.443, p=.000) increased with SS. Greater SS was associated with a more plantarflexed ankle position at heelstrike (r=.270, p=.032) and stance (r=.319, p=.011) and a less flexed knee in stance (r=-.252, p=.046). Peak ankle power absorption (r=.582, p=.000) and ankle eccentric work (r=.291, p= 025) increased with SS. Eccentric knee work (r=-.363, p=.005) decreased with SS. Peak knee power generation (r=.387, p=.002) and ankle power generation (r=.380, p=.003) increased with SS. Age had weak relationship with the same. The HBF (r=-.341, p=.006), HPF (r=-.261, p=.037) and VPF (r=-.422, p=.001) decreased with age. An increase in age was associated with a more PF in stance phase (r=.283, p=.025). Knee power absorption (r=-.344, p=.008), APA (r=-.370, p=.004), KPG (r=-.263, p=.044) and APG (r=-.266, p=.042) decreased with age. **Conclusion.** BV are unlikely to be influenced by the FT, but affirmatively by the SS, and to a lesser extent the age of the runner.

32. PHYSICAL ACTIVITY AND OBESITY IN 10-15 YEAR OLD MALES IN THE NORTHWEST PROVINCE OF SOUTH AFRICA: THUSA BANA STUDY

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The **aim** of this study was to investigate the association between physical activity and measures of obesity in 10 - 15 year old males in the North West Province, as well as to investigate the influence of urbanisation on the association between physical activity and obesity. **Method:** A total of 610, 10 - 15 year old male subjects, which were part of 1257 pupils measured during the THUSA BANA study in the Northwest Province of South Africa during 2000 and 2001. Demografic data and physical activity participation were obtained through standarised questionnaires. Anthropometric data were also collected using the methods as described by Norton and Olds (1996). Data analyses were performed using Statistica 2000 (Stat Soft, Inc) for Windows 98. To indicate the difference between variables, one-way analysis of variance, Tukey post hoc HSD tests and two-way analysis of variance were used. **Results and conclusions:** Physical activity was not significantly associated with percentage body fat, body mass index and the sum of triceps and subscapular skinfolds in analysis of variance (ANOVA). Although there were no statistically significant differences ($p<0.05$) between physical activity and the measures of obesity, a trend that the measures of obesity increased with a decrease in physical activity were observed. In the application of the two-way analysis of variance to determine the influence of age on the relationship between physical activity and obesity, no significant relationships were shown. There were also no significant associations found in the application of the two-way analysis of variance to determine the influence of urbanisation on the relationship between physical activity and obesity. A trend that the rural subjects had lower values of measures of obesity than the urban subjects were observed. Semi-urban subjects had the lowest values for all the measures of obesity, independent of their level of physical activity. This could possibly mean that socio-economic status play an important role in the prevalence of obesity.

Various

33. IMPROVEMENT IN FUNCTIONAL CAPACITY IS INDEPENDENT OF CHANGES IN ANKLE BRACHIAL PRESSURE INDEX (ABPI) FOLLOWING EXERCISE TRAINING IN PATIENTS WITH PERIPHERAL VASCULAR DISEASE (PVD).

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It is widely believed that improvements in walking distance are related to increased blood flow following exercise training in patients with PVD Therefore, the ABPI is commonly assessed. In this study, 17 pts with PVD were randomised to a 6 wk exercise rehabilitation programme (ER; n=9) or to a control group given usual care (exercise advice;CONT; n=8). Before and after intervention both groups performed: i) graded treadmill exercise to determine maximal walking distance (MWD) and pain free walking distance (PFWD) and VO2max, VE, and RER; and ii) measurement of ankle brachial pressure index (ABI) by means of a Doppler device, at rest and immediately after treadmill testing. At baseline, all parameters were similar between ER and CONT. ABPI tended to fall after graded exercise in both groups (0.58 (0.3 to 0.4 (0.4 ; ER, P=0.17; 0.85 (0.2 to 0.6 (0.4; CONT,P=0.04). After intervention, MWD in ER increased from 300 (198 to 514 (226 m; (P<<0.05) but was unchanged in CONT (460 (200 vs. 430 (151 m; P=NS). Similarly VO2peak increased after ER (14.7 (3 vs 19.4 (5 mlO2.kg.min-1 ; P<0.05) but was unchanged in the CONT group (18.2 (4 vs. 17.6 (3 mlO2.kg.min-1;P=NS). However, resting (0.58 (0.3 vs. 0.4 (0.5 ER, P=NS; 0.85 (0.2 vs. 0.6 (0.1; CONT, P=NS) and post exercise (0.4 (0.4 vs. 0.41 (0.4; ER, P=NS; 0.6 (0.4 vs. 0.55 (0.3; CONT, P= NS) ABPIs were unchanged in both groups after intervention. These results suggest that improvements in MWD and VO2max following exercise training occur despite an absence of improvement in the ABPI. Thus the use of a graded exercise test to monitor functional capacity and disease progression in patients with PVD is superior to using the ABPI.

34. EFFECTS OF UPPER BODY STRENGTH TRAINING VS CONVENTIONAL EXERCISE REHABILITATION IN PATIENTS WITH PERIPHERAL VASCULAR DISEASE (PVD).

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Upper body cycle ergometry has been shown to be effective in increasing walking distance in patients with claudication. This study compared the effects of 6 wk upper body strength training programme (UBST; n=9) to conventional (walking, cycling, circuit) exercise rehabilitation (ER; n=9) in patients with PVD. A third group of patients with PVD discharged and instructed to walk as "much as possible" served as the control group (CONT; n=8). Before and after intervention all groups performed a standard graded treadmill exercise to determine maximal walking distance (MWD), pain free walking distance (PFWD) and VO2peak, VE, and RER. At baseline, all parameters were similar between UBS, CER and CONT groups. After intervention, MWD in ER increased from 300 (198 to 514 (226 m; ([mean (SD]; P<0.05) but was unchanged in the UBST (390 (211 to 399 (186 m; P=NS) and CONT group (460 (200 vs. 430 (151 m; P=NS). Similarly VO2peak increased after ER (14.7 (3 vs. 19.4 (5 mlO2.kg.min-1; P<0.05) but was unchanged in the UBST group (19.6 (5 vs. 18.7 (6 mlO2.kg.min-1; P=NS) and CONT groups (18.2 (4 vs. 17.6 (3 mlO2.kg.min-1;P=NS) following training. PFWD tended to increase after intervention in ER (126 (156 vs. 256 (187 m; P=0.07) and USST (128 (121 vs. 202 (175 m; P=0.07) but was unchanged in the CONT group (175 (123 vs. 175 (135 m). Peak RER and VE, did not change in any group following intervention. The results of this study suggest that

I) 6 wks of ER improved MWD and VO2peak in patients with PVD but UBST over this period did not improve these parameters. Thus conventional programmes should be prescribed to improve walking tolerance. II) Verbal encouragement to exercise upon patient discharge is an ineffective form of management to improve functional capacity in patients with PVD.

35. DOES PRE-SEASON TESTING OF FITNESS PREDICT INJURY RISK IN CLUB RUGBY PLAYERS? A PROSPECTIVE COHORT STUDY

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Background: Rugby is a contact sport associated with a high risk of injury. There is extensive documentation on the nature of rugby injuries however there is limited research on key risk factors and injury prediction. The aim of this prospective cohort study was to determine if preseason testing for potential risk factors predicts injury risk in club rugby players as measured by injury incidence rate (injuries per 1000 hrs play) and playing time missed. **Methods:** A prospective cohort study consisting of 102 male club rugby players was conducted for the 2001 rugby season. All players underwent preseason fitness testing, which included flexibility tests, isokinetic muscle strength testing, body composition measurements, strength endurance, agility and cardiovascular fitness testing. All injuries (defined as any injury which prevented a player from participating in a training session or match) sustained during the season were recorded. The severity of an injury was classified as minor, intermediate and severe in terms of the amount of playing time missed. The mechanism of injury, the position played and time in the game at which injury occurred was recorded. The cohort was divided into quartiles for each measured variable and the incidence of all injuries and lower limb injuries was compared between quartiles using a Chi-square test. **Results:** There were no significant differences ($p>0.05$) in the incidence of injuries between preseason quartiles for body mass index, years playing rugby, quadriceps and hamstring isokinetic muscle strength, flexibility, strength endurance, agility, endurance ability or power for all injuries and lower limb injuries sustained in the subsequent season. **Conclusion:** The findings of this study fail to support the common hypotheses that pre-season fitness assessments can be used to identify risk factors for subsequent injuries during a rugby season.

36. THE USE OF DNA DAMAGE ANALYSIS AS CRITERIA FOR PRESCRIBED AEROBIC EXERCISE IN INTENSITY

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The research of Paffenbarger (1984) forms the base for the compilation of a physical training program of ± 70% of the age-adapted heart rate. The latest view is that moderate physical exercises (< 50% V02 max) may hold better health benefits for the participant than the suggested 70% nor. This is due to the advantageous effect on the anti-oxidant system of the body which increases the resistance to free radicals. Exercise increases the enzymatic anti- oxidant mechanism against free oxygen radicals, but simultaneously there is a release of the free oxygen radicals as a result of a higher muscle mass that accompanies high intensity exercises. For the individual with diseases like cancer, AIDS and other chronic illnesses, that already has a negative free radical anti-oxidant imbalance, high intensity exercises may have more disadvantages than advantages. The degree of oxidative stress that the body experiences is equal to the level of DNA damage experienced. Therefore it is important to investigate on a molecular level, using DNA damage analysis, at which exercise intensity the anti-oxidant system of the body will be influenced advantageously without exceeding the anti-oxidant capacity. DNA damage is determined, after performing a physical work capacity test at an intensity of 70% of the age-adapted heart rate, by taking blood samples at different time intervals. The blood is put into a gel-medium and undergoes electrophoresis. The samples are treated with DNA stain and analysed under the florescence microscope for DNA damage. Significant structural DNA changes (damage) are detected at approximately 16 hours after exercise, and complete DNA repair is observed after 72 hours.

37. THE RELATIONSHIP BETWEEN ANTHROPOMETRIC VARIABLES AND TESTS OF PHYSICAL PERFORMANCE IN JUNIOR SOCCER PLAYERS, AGED 9 - 12 YEARS.

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There is much contention surrounding the relationship between anthropometric variables and performance in youth and development level sport. The aim of the research was to determine the influence of anthropometric variables on tests of physical performance in young athletes. Male soccer players aged 9-12, engaged in regular high-level competition, were selected for the study. Anthropometric data was collected and compared to performance in the vertical jump test, 40-metre sprint test and an aerobic endurance test. Mean scores for selected measurements for each age-group are tabulated below.

Age-group	**9 & 10 (n=10)**	**11 (n=15)**	**12 (n=20)**
Body fat (%)	17.0 (± 9.15)	15.8 (± 8.29)	11.2 (± 3.72)
Endomorphy	2.3 (± 1.26)	2.5 (± 1.37)	1.9 (± 0.58)
Mesomorphy	4.1 (± 1.07)	4.4 (± 1.08)	4.0 (± 0.89)
Ectomorphy	3.4 (± 1.48)	3.1 (± 1.13)	3.7 (± 1.0)
Acceleration [0-5m] (sec)	1.308 (±0.077)	1.285 ((0.092)	1.262 (±0.08)
Anaerobic power (watts)	369.9 (±67.72)	451.1 (± 95.41)	491.9 (± 86.6)
Endurance score	79.6 (± 22.91)	74.6 (± 34.86)	89.1 (± 12.67)

The correlation between anthropometric variables and physical performance tests was conducted using the Pearson product-moment technique. The only highly significant relationships reported ($r>0.70$) were those between anthropometric variables and anaerobic power (calculated from vertical jump height and body mass). The most significant variables were limb girths (calf and arm), bi-epicondylar (humerus) breadth, bi-condylar (femur) breadth and height. No significant relationships with the other tests were reported. It is important to note that no significant relationship between body fat percentage and performance was found. This may indicate that it is not necessary to use tests of body composition for selection purposes or to predict performance in junior soccer players.

38. THERE WAS NO ASSOCIATION BETWEEN THE -55 C/T POLYMORPHISM WITHIN THE UCP3 GENE AND PERFORMANCE DURING THE SOUTH AFRICAN IRONMAN TRIATHLON

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Background: Genetic epidemiological and gene linkage studies have shown that genetic elements are, at least in part, associated with physiological characteristics believed to be associated with athletic ability. However, no evidence conclusively links any specific gene(s) with athletic ability. The uncoupling protein 3 (UCP3) gene was chosen as a potential genetic marker of athletic ability due to UCP's proposed roles in total body energy expenditure and fatty acid metabolism, all of which may distinguish top ultra-endurance triathletes from their less

elite counterparts and/or non ultra-endurance individuals. **Objective:** The aim of this study, therefore, was to determine whether the -55 C/T polymorphism within the promoter region of the UCP3 gene is associated with the athletic ability of ultra-endurance Ironman triathletes. **Subjects and Methods:** Two triathlete groups consisting of the 89 fastest and the 89 slowest Caucasian, male triathletes who completed either the 2000 or 2001 South African Ironman triathlon events, and who agreed to participate in this study, were genotyped for the -55 C/T polymorphism within the UCP3 gene. A control group consisting of 92 Caucasian males who had not trained for or participated in an ultra-endurance event was also genotyped. **Results:** There was no significant difference in the genotype (CC, CT and TT) frequency distributions of the -55 C/T polymorphism within the UCP3 gene between the fast triathlete (54 CC, 60.7%; 29 CT, 32.6%; and 6 TT, 6.7%), slow triathlete (57 CC, 64.0%; 27 CT, 30.0%; and 5 TT, 5.6%) and control (50 CC, 54.4%; 35 CT, 38.0%; and 7 TT, 7.6%) groups (Pearson Chi-square: 1.85, p=0.763). In addition, no significant differences were observed between the frequencies of the C and T alleles between the fast triathlete (137 C, 77.0% and 41 T, 23.0%), slow triathlete (141 C, 79.2% and 37 T, 20.8%) and control (137 C, 74.5% and 47 T, 25.5%) groups (Pearson Chi-square: 1.15, p=0.56). Finally, when divided into the three groups according to their UCP3 genotype, no particular genotype or allele was associated with the time taken by the triathletes to complete the entire triathlon, or to complete either the swim, cycle or run legs of the event. Conclusions: No association was found between the -55 C/T polymorphism within the UCP3 gene and the ultra-endurance performance of triathletes who completed either the 2000 or 2001 South African Ironman triathlons.

39. RARE SPORTS INJURIES IN TEAM HANDBALL - TWO CASE REPORTS WITH BONE FRACTURES OF THE HAND SKELETON

DO Gottwald

Aim: Literature analysis shows a high injury incidence in team handball. But injuries with bone fractures of the hand skeleton are rare. We observed two handball players with those fracture forms and want to report about diagnosis, treatment and results. **Method** Retrospective analysis of two players with bone fractures of the hand skeleton occurred during team handball (case one: 26 years old, bone fracture of the Os scaphoideum ; case two: 42 years old, Bennett¥s-bone fracture of the Os metacarpale I). Both bone fractures were treated with a scew osteosynthesis followed by a plaster cast. **Result** The X-ray examination showed a complete fracture consolidation 8 weeks postoperatively. At this point we prescribed tape casts. We recommended the beginning of the specific training another four weeks later. At the time of reexamination the functional assessment was excellent for both. There was documented no movement or power deficiency. **Conclusion** Bone fractures of the hand skeleton are rare in team handball. Early diagnosis and correct fracture fixation are necessary for a good result.

40. BONE MINERAL DENSITY IN PRE-ADOLESCENT GIRLS OF VARIOUS ETHNIC GROUPS

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We investigated determinants of Bone Mineral Density (BMD) in a cross-sectional sample of girls between the ages of 8-11 years from different ethnic groups. Subjects included 210 premenarcheal black (n=80), white (n=41), mixed ancestral origin (n=77) and Indian (n=12) girls from 6 schools in the Cape metropolitan area. Height, weight and anthropometry were completed on all subjects. Demographics, dietary calcium intake, physical activity, and pubertal development were quantified by self-report and questionnaires. BMD was measured using calcaneal quantitative ultrasound. Data were analysed using analysis of variance, across ethnic groups. Subjects of mixed ancestral origin were heavier than black subjects (35.2 ± 9.7 vs 31.5 ± 7.3 kg; p<0.01), while black subjects were also smaller in stature compared to subjects of mixed ancestral origin (1.29 ± 0.08 vs 1.35 ± 0.08m; p<0.001) and white subjects (1.29 ± 0.08 vs 1.34 ± 0.07m; p<0.001). Calcium scores of the black subjects were significantly higher than that of white subjects (22.8 ± 12.6 vs 16.0 ± 8.4; p<0.001). Total Peak Bone Strain Scores (TPBSS), measures of weight-bearing physical activity, were significantly higher in white girls (7.41 ± 3.9) compared to girls of mixed ancestry (5.36 ± 2.9; p<0.001) and black girls (4.34 ± 1.8; p<0.001). Estimated BMD in black girls (0.551 ± 0.084 g.cm-2) and girls of mixed ancestral origin (0.531 ± 0.088 g.cm-2) was significantly higher (p<0.001) than that of white girls (0.469 ± 0.064 g.cm-2). Co-varying for age, weight and pubertal development did not affect these results. For the whole group, calcium intake correlated significantly with BMD (r=0.15; p<0.05). In conclusion, all bone parameters were substantially higher in black subjects, who consumed more calcium on average, however, were lighter, smaller and performed significantly less weight bearing physical activity than the other ethnic groups.

Exercise science

41. DOES A SIX-WEEK BACKWARD TRAINING PROGRAM IMPROVE THE GENERAL FITNESS LEVEL AND PHYSIQUE OF YOUNG WOMEN?

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Background: Previous studies have shown that some of the physiological and mechanical adjustments made during the novice task of backward walking/running include the concentric contraction of the quadriceps, a larger recruitment of motor units in the working muscles, smaller stride length and increased stride frequency. These adjustments are the reasons for greater metabolic demands during backward locomotion compared to forward locomotion. **Aim:** This study investigated the effect of a backward training program on the physical - and fitness condition of young women. **Methods:** 26 Healthy female university students (aged 18-23 yrs) took part in three different baseline tests: body composition, a submaximal treadmill test and a 20m shuttle run test. Subjects were then divided into a training group (n=13) and a control group (n=13). The training group completed a six-week backward run/walk training program. The control group was restricted to their daily activities similar to the four weeks prior to the onset of the baseline tests. **Results:** The training group showed a statistically significant decrease in O2 consumption during both submaximal forward and backward exercise on the treadmill (32% decrease during backward and 30% decrease during forward exercise, p<0.05). The training group also showed a statistically significant decrease in percentage body fat (2.4%; p=0.01) and a 19.7% decrease in the sum of skinfolds (p=0.001). The training group showed a statistically significant improvement in predicted VO2max values from the forward 20m shuttle run test (5.2% improvement compared to 0.8% improvement in the control group, p=0.013). **Conclusion:** Backward walk/run training improves cardio-respiratory fitness for both forward and backward exercise and cause significant changes in body composition in young women.

42. ESTABLISHING HEART RATE TRAINING ZONES FOR CANOEING

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Maximum heart rate for upper body exercise is traditionally given as being as many as 13 beats/min lower than for maximum lower body exercise. Many canoeists now use heart rate monitors during training and request guidance on setting heart rate training zones. Existing training guidelines are based on lower limb derived heart rates which may not be appropriate. **Aim:** To compare the relationship between heart rate and oxygen consumption when exercising on either a treadmill or a kayak ergometer. **Method:** 15 canoeists, who compete regularly, were studied. They were randomly assigned to either a VO_2max test on a treadmill or a kayak ergometer using open circuit spirometry. They returned within 5 to 7 days for a VO_2max test on the other apparatus. **Results:** At VO_2 max on the kayak ergometer, average maximum heart rate was lower than on the treadmill, 171.9 ± 8.8 vs 177.1 ± 7.6 beats.min-1 (p=0.0002), as was oxygen consumption 40.7 ± 8.5 vs 50.9 + 6.6 ml.kg-1.min-1 (p<0.0001), ventilatory volume 111.3 ± 26.2 vs 132.7 ± 22.0 l.min-1 (p=0,0002) and tidal volume 2.4 ± 0.7 vs 2.9 ± 0.5 l.min-1 (p=0.033). At respiratory exchange ratios (RER) of 0.85, 0.9, 0.95 and 1.0, average heart rates were not significantly different but were significantly lower on the kayak ergometer at an RER of 1.05 (p=0.014). On the kayak ergometer, oxygen consumption was significantly lower at all RER's, as were tidal volumes. Respiratory rate was however significantly increased at all RER's. **Conclusion:** Heart rate response to kayak and treadmill exercise is similar up to exercise intensities eliciting an RER of 1.0 while oxygen consumption is consistently reduced at all intensities on the kayak ergometer. The cardiac reserve available after an RER of 1.0 is reduced on the kayak ergometer. Kayak training based on a percentage of maximum lower limb heart rate, will result in an upper limb percentage VO_2max utilisation that is about 3% higher than the average percentage VO_2max utilisation obtained with the lower limbs.

43. CHANGES IN PLASMA AMINO ACIDS (AA) FOLLOWING AN ULTRA-MARATHON

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During an ultra-endurance event, AA may be recruited to provide substrate for gluconeogenesis as well as for *de novo* synthesis of proteins. The purpose of this study was to determine changes in plasma AA in 5 experienced volunteers (4 males, 1 female), 24 h prior to projected finishing time, immediately after (IPE), 3 h, 24 h, and 72 h after an ultramarathon. **Methods:** Venipunctures were performed and plasma was stored at -80o C until analysis, using HPLC. Results were analyzed using a repeated measures ANOVA (p<.05) and where appropriate post-hoc tests were performed. **Results:** All values were compared to pre-race values. The following AA were decreased IPE (p≤ .05): alanine (-34%), arginine (-37%), aspartimine (-33%), glutamine (-26%), isoleucine (-52%), leucine (-49%), and lycine (-24%). The following AA were significantly elevated at 3 h: histadine (+18%) and tryptophan (+44%). The following AA were significantly altered IPE as well as at 3 h, respectively: glycine (-35% and -25%), phenylalanine (+29% and +44%) and proline (-63% and -48%). **Conclusion:** In experienced ultra-distance runners, most pre-race AA were within the normal range, and all AA returned to pre-race values by 24 h.

44. INVESTIGATING BLOOD FLOW IN THE EXERCISING PARAPLEGIC: HOW DOES THIS CONTRIBUTE TO THE UNDERSTANDING OF CONTROL OF MUSCLE BLOOD FLOW DURING EXERCISE?

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Aim: Skeletal muscle blood flow during exercise is regulated by a cascade of mechanisms. There is no consensus on which determinant plays the most critical role. We studied the diameter and blood flow of the large conduit arteries (brachial and femoral) in paraplegic vs. able-bodied subjects. **Methods:** Duplex doppler studies were done on 10 elite wheelchair basketball players (EP), 10 sedentary paraplegics (SP) en 10 able-bodied subjects (AB). Tests were done at rest and after 2 bouts of arm ergometer exercise: a maximal incremental test and 3 minutes at 75% of maximal. **Results:** Resting diameter in the common femoral artery (CFA) was similar in EP (5.93 mm ± 1.54) compared to SP (6.52 mm ± 0.95), which were both significantly lower than AB (7.87 mm ± 1.38), p<0.05. There were no differences in resting mean velocity (Vmean) or pulsatile index (PI) in the CFA. There were also no differences in the brachial artery (BA) between the 3 groups at rest for diameter, Vmean or PI. Results immediately post-exercise were very variable for maximal and submaximal tests, with no significant differences in Vmean, PI or diameter between groups in either CFA or BA. When the lesion levels were considered however, significant differences were found for maximal CFA diameter (p = 0.005 for T6 and above in EP vs. AB and p = 0.05 EP[below T6] vs. AB), and maximal CFA blood flow (EP T6 and above vs. AB, p<0.04). **Conclusion:** The difference in CFA diameter at rest in the SP vs. AB group confirms previous results. Our observation that the CFA diameters of EP and SP do not differ significantly at rest, suggests that training does not have a spillover vasomotor effect on non-innervated conduit arteries. We also showed no different pattern in the dynamic response to exercise of conduit arteries in the paralysed vs. able-bodied subjects. The lesion influence supports the notion of a significant role for neural control in the regulation of blood flow.

45. HAEMATOLOGICAL RESPONSE TO ULTRAMARATHON RUNNING. A COMPARISON BETWEEN HIGHLY TRAINED, FAST AND LESS TRAINED, SLOW RUNNERS.

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Aim Haematological response to the 2001 downhill Comrades Marathon was compared in high (>120 km/wk in training; 3 weeks of pre-race taper; HTS) and low (<80 km per week in training; 2 weeks of pre-race taper; LTS) training status groups. **Methods:** Full blood counts, differential lymphocyte counts, serum cortisol, C reactive protein (CRP) and creatine kinase (CK) were measured in blood samples donated 21 hours before and 16 hours after the ultramarathon using standard automated and flow cytometry techniques. **Results:** The HTS group did not differ significantly from those of the LTS in terms of pre-race full blood and differential lymphocyte counts or serum cortisol, CK and CRP concentrations. Despite significantly faster mean race finishing time (8h03 vs 10h53; p<0.001) and higher post-race markers of muscle inflammation and serum cortisol in the HTS group, these faster runners did not show evidence of a slower post-race recovery in terms of total leukocyte (p<0.42), neutrophil (p=0.24) or total lymphocyte (p=0.54) counts. Differential lymphocyte counts determined in the 16-hour post-race samples (CD4+,CD8+,CD19+,CD56+) were also not significantly different (p>0.05) between the HTS runners and less trained runners who had spent an average of 2 hours 50 minutes longer on the road. **Conclusion:** Despite greater evidence of post-race muscle inflammation in the faster runners in a downhill ultramarathon race, the haematological recovery of well trained runners who undergo a 3-week taper period prior to the ultramaramarathon is well matched to that in

less trained runners who spend almost three hours longer on the road.

46. THE *BST*UI RFLP WITHIN THE COL5A1 GENE IS ASSOCIATED WITH CHRONIC ACHILLES TENDONOPATHY

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Background: Although it is well established that there is a high incidence of chronic Achilles tendon injuries as a result of participation in physical activity, the exact mechanisms that cause these conditions are poorly understood. Some studies, however, have suggested that some individuals have a genetic predisposition to this condition. **Objective:** The aim of this study therefore was to determine whether the COL5A1 gene, which encodes for a minor structural protein found in tendons, is implicated in the pathogenesis of chronic Achilles tendinopathy. **Subjects and Methods:** Fifty-three Caucasian subjects diagnosed with chronic Achilles tendinopathy (AT) using clinical criteria and 115 non-injured Caucasian control subjects (CON) were genotyped for the BstUI restriction fragment length polymorphism (RLFPs) within the COL5A1 gene. **Results:** There was a significant difference in the allele frequencies (A1, A2 and A3) of the BstUI RLFP within the COL5A1 gene between the injured and non-injured subjects (Pearson ?2=15.3, p=0.0005). The frequencies of the A1 (AT 78.3% vs CON 67.0%) and A3 (AT 5.7% vs CON 0.8%) alleles were higher in the AT group than in the CON group, while the frequency of the A2 allele was higher in the CON group than in the AT group (AT 16.0% vs CON 32.2%). Therefore, individuals with an A2 allele are less likely of developing chronic Achilles tendinopathy (odds ratio of 2.5; 95% CI 1.4 - 4.5). **Conclusions:** The BstUI RFLP within the COL5A1 gene is associated with chronic Achilles tendinopathy and that the A2 allele of this gene appears to have a protective role.

47. AN ELECTROENCEPHALOGRAPHIC INVESTIGATION OF BRAIN ACTIVITY ASSOCIATED WITH FATIGUE DURING STATIC EXERCISE

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Objectives: To investigate brain areas or circuits associated with fatigue during an isometric exercise. **Subjects:** Nineteen subjects of varying physical activity levels participated in this study. **Methods:** An electroencephalographic (EEG) recording (128-electrode) was obtained during rest with the subjects' eyes open. Subjects then performed a maximal isometric knee extension (MVC) and, after resting, an isometric submaximal (20% MVC) knee extension until they could no longer maintain the 20% force output. EEG was measured during the submaximal fatigue test and the data normalised to the resting state measurements. The data was divided into five frequency bands for analysis - theta (4-8Hz), alpha1 (8-10.5Hz), alpha2 (10.5-13Hz), beta (13-20Hz) and gamma (20-40Hz). Electromyographic (EMG) measurements were taken during the submaximal test and normalised to measurements from the maximal test. EEG and EMG data were expressed over ten time periods (each reflecting 10% of the time to exhaustion) to show changes in brain and neuromuscular activity with time. Changes in EEG power were calculated relative to time period one of the fatigue test so as to reflect only fatigue-related changes. **Results:** Subjects lasted an average of 188 ± 57s during the fatigue test, during which time the EMG amplitude increased significantly ($p<0.01$) and the EMG frequency decreased significantly ($p<0.01$). There were significant increases in power from the first time period in the theta, alpha1 and beta bands for many brain regions during the fatigue test. The regions showing this increased activity were different between the frequency bands. There were no significant increases in power between time period one and any of the following time periods in the alpha2 and gamma bands. **Conclusions:** The theta, alpha1 and beta frequency bands show different patterns of activity with increasing fatigue and appear to represent different neural circuits with specific functions and incorporating many brain regions. Increases in theta and alpha1 activity appear to be associated with memory. Beta activity suggests internal vocalisation and activation of brain areas signalling homeostatic distress, with right hemisphere domination in the final stage of the trial consistent with negative avoidance behaviour and a decision to terminate the task.

48. ULTRASTRUCTURAL CHANGES IN THE SKELETAL MUSCLE OF ATHLETES WITH ACQUIRED TRAINING INTOLERANCE

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Background: Although the health benefits of regular exercise are well established, there is substantial evidence to suggest that the high volume training and racing regimes of endurance athletes' results in extensive skeletal muscle damage. Although skeletal muscle has a remarkable capacity for repair it is not known if there are limitations to this capacity. Endurance athletes with a history of high volume endurance training, a precipitous decline in running performance and acquired training intolerance provide a fortuitous model whereby we may study the effects of long term, high volume endurance training on skeletal muscle. This study investigated the incidence of typical ultrastructural markers of exercise-induced skeletal muscle damage in the muscle of athletes with acquired training intolerance and compared it to that of asymptomatic endurance athletes. The two groups of athletes were matched for age and years of endurance training. **Methods:** Descriptive and physiological data was obtained from 18 symptomatic athletes and 16 asymptomatic athletes. Muscle biopsies of the vastus lateralis were obtained from all the athletes and the incidence of ultrastructural markers of exercise-induced muscle damage was assessed using electron microscopy. **Results:** Although the symptomatic and asymptomatic athletes were well matched for age and years of endurance training, the symptomatic athletes trained a significantly greater number of days, kilometres and hours per week. Electron microscopic analysis of the muscle biopsies revealed a significantly increased incidence of z-disc streaming in the symptomatic athletes. **Conclusions:** Symptomatic athletes present with an increased incidence of various forms of skeletal muscle ultrastructural abnormalities compared to asymptomatic control athletes. Although the results of this study do not allow us to establish cause and effect between prolonged, high volume endurance training and skeletal muscle ultrastructural abnormalities, it is tempting to speculate that the increased incidence of skeletal muscle ultrastructural disturbances noted in the symptomatic athletes may be related to the increased training volume of these athletes.

49. SERUM ELECTROLYTES AND HYDRATION STATUS ARE NOT ASSOCIATED WITH ELECTROMYOGRAPHIC (EMG) ACTIVITY IN TRI-ATHLETES WITH EXERCISE ASSOCIATED MUSCLE CRAMPING (EAMC)

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Objectives: To compare the serum electrolyte concentrations in cramping and control Ironman tri-athletes and to investigate the baseline recovery electromyographic (EMG) status of cramping Ironman tri-athletes. **Subjects:** All tri-athletes who registered for the 2000 South African Ironman were considered potential subjects. **Methods:** All tri-athletes were weighed pre- and immediately post-race. Tri-athletes suffering from Exercise Associated Muscle Cramps (EAMC) after the race formed the cramping group (CR). Non-cramping tri-athletes matched for race finishing time and body mass formed the control group (CON). Baseline EMG was recorded from the control muscle (triceps) and the most severely cramping lower limb muscle (quadriceps, hamstring or calf) of the CR group. EMG data was recorded at the beginning of every minute for 10 minutes of recovery. Blood samples were drawn from both the CR and CON groups during recovery for the analysis of plasma magnesium, glucose, sodium, potassium and chloride concentrations. Haemoglobin and hematocrit were also measured. **Results:** There were no significant differences between the CR (n=11) and CON (n=9) groups for pre- or post-race body weight or % dehydration. Post-race sodium concentration was significantly higher ($p < 0.05$) in the CON (n=9) group than the CR (n=9) group (142.7 (3.0 versus 139.5 (1.7 mMol.L-1) but this was not clinically significant. There were no other significant differences between the two groups for post-race serum electrolytes, glucose, haemoglobin concentrations or hematocrit. Cramping muscles' EMG (mV) (n=11) was significantly higher ($p < 0.05$) than the control muscle's EMG (n=11) for minutes 0 (immediate recovery), 3, 4 and 5 of the 10-minute recovery. There were no significant differences over time. Post-race potassium concentration was positively and significantly correlated with recovery EMG ($r = 0.7$) whereas post-race plasma magnesium and sodium as well as % dehydration were not. **Conclusions:** EAMC is not associated with % dehydration or serum electrolyte concentrations. Cramping muscles' recovery EMG reflects an increased baseline activity, which may indicate an altered reflex activity caused by fatigue.

Posters

50. RELATIONSHIP BETWEEN RUNNING ECONOMY, FLEXIBILITY AND HYPERMOBILITY IN SEDENTARY FEMALES.

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Background: Previous research has demonstrated a significant relationship between running economy and flexibility in trained males, and specifically a relationship between running economy and plantar flexion, and maximal hip external rotation. However, no research has investigated whether this relationship exists in females. Additionally, the role of hypermobility in running economy has not been examined. **Aim:** Therefore the purpose of this study was to determine any relationship between flexibility, hypermobility and running economy in college-age sedentary female volunteers (n = 21). **Methods:** A continuous gas analysis was performed while subjects ran on a treadmill for 5 min at 9 km and 12 km/h on a level grade. Flexibility of the hip and ankle joints was assessed by goniometer. Hypermobility was measured using the modified Crater and Wilkinson score. Results were analyzed using a Pearson correlation co-efficient ($p < 0.05$). **Results:** Surprisingly no significant correlation was found between running economy and flexibility of the ankle ($p = 0.674$), and hip ($p = 0.199$). There were also no correlation between running economy and hypermobility ($p = 0.275$). However, the relationship between running economy and body fat ($p = 0.098$), and endomorph component ($p = 0.087$) were approaching significance. **Conclusion:** Flexibility and hypermoblity in sedentary college age females does not correlate with running economy. It is suggested that these factors should be further investigated in endurance trained female subjects.

51. POSSIBLE EFFECT OF EXERCISE ON THE HAND-EYE COORDINATION OF CRICKET PLAYERS

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Introduction: Over the past few years aspects like hand-eye co-ordination, visual reaction time and eye exercises have been addressed. Theories that visual involvement varies according to the environmental demands, and therefore athletes' visual characteristics vary according to the sports in which they specialize, have also been covered.[1] Further studies in this field also show that the environmental demands has to be matched by the motor response. The extension of this theory shows that visual ability can affect both motor learning and performance. The nature of the visual involvement will vary according to environmental demands.[2] The proposition that good visual ability is an essential factor for sporting excellence is supported by a large body of literature.[3] However, some aspects of hand-eye co-ordination are still to be investigated. **Materials and methods** The Sport Vision Testing Battery consists of 5 different hand-eye co-ordination tests. Each of these tests were carried out before and immediately after a period of exercise. The subjects were placed on a treadmill for 5 minutes at an average speed of approximately 12 km/h. The gradient was zero during the first minute; thereafter it was lifted by 1 setting every minute. Directly after the period of physical exercise the appropriate test was repeated. **Subjects:** Fifteen highly skilled cricket players (18-28 years), who are currently playing on a provincial level, were tested by using all five hand-eye co-ordination tests. Six of the subjects served as a control group (thus not participating in the exercise) while the other nine participated in exercise between every repeated test. The testing was blind in the sense that none of the players knew beforehand whether they were in the control or exercise group. **Results:** The pre- and post exercise values of the subjects in the control and experimental group were pooled to determine the averages and differences. Statistical distribution was determined by using the Wilcoxon 2 Sample Test (Normal Approximation - with Continuity Correction of .5). Analyses of the data showed an increase (Accuvision 1000 - test 2) and decrease (Accuvision 1000 - test 1) in flashing lights been touched. In some tests a significant increase in points (tachistoscope), catches (strobespecs), touches (wayne trainer) and decrease in time (rotator pecboard), were observed after a period of moderate exercise intensity. **Discussion:** After the period of moderate exercise there was a significant difference in scoring in the Tachistoscope, Strobespecs, Wayne Trainer and Rotator pecboard, suggesting an improvement in eye-brain-hand-foot co-ordination, visual response speed, accuracy, short term visual memory, anticipation and visual concentration. No significant difference was seen in the Accuvision 1000 tests, probably due to no effect on peripheral awareness. **Conclusion** Sport has entered a modern and scientific era where visual performance plays an important role in training programmes. It is thus possible that the test protocol followed in this study may play an important role in better concentration, performance and motivation.

52. THE INFLUENCE OF EXHAUSTION ON THE METABOLISM AND PERCEPTUAL MOTOR PERFORMANCE OF PROFESSIONAL CRICKET PLAYERS

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Introduction: A subject's response to endurance exercise is determined by the resultant response of several interrelated control systems. This response (performance) is finally determined by a tightly attached partnership (ratio) between oxygen transfer to and carbon dioxide removal from the exercising cells and secondly (not less important) the capacity of the cells to produce ATP aerobically. The capacity of an individual to endure exercise can therefore be approximated if the above responses can be measured. The maximal capacity for oxygen consumption is usually expressed as the VO_2 max, which signifies the maximal cardiopulmonary potential (4,5). It is furthermore known that fatigue at synaptic level (eg nerve-muscle interface) can occur as result of overstimulation. Muscle fatigue due to inadequate supply of nutrients and oxygen during prolonged exercise also occur (6,7). Nervous feedback from the fatigued muscle to the muscle control system in the central nervous system gives input regarding the state of muscle activity. In this study we hypothesise that the relationship of metabolic variables in the muscle to central nervous system inhibition of muscle performance may differ between individuals. In order to measure the athletic ability of an individual it is therefore important not only to measure the cardiopulmonary (5) and metabolic status (8,9) of the individual but also the individual's mechanical performance ability. Thus nervous aspects like perceptual motor coordination, reaction time, anticipation ability, as well as the real actions required for each type of sport should also be measured to get an indication of an individual's performance ability. **Methods:** 25 Academy cricket players (19-31 years) were exposed to a double blind, placebo controlled,

experiment study so as to form: a control group (Con, n=5); an exercise group (E, n=10); and a diet + exercise group (ED, n=10). The players were put on a balanced diet. The players in group ED also received a commercial carboloading drink, while players in group Con and E the placebo drink with the same colour and flavour as the carbo-drink. The cricket players [groups E and ED], after determining each player aerobic endurance intensity, performed a controlled run on a treadmill. Group Con were not subjected to any exercise. Before and directly after this running episode mental coordination studies were executed (groups Con, E, ED). These include a standardised eye-hand coordination tests, an event anticipation test, a reaction time tests. **Results and discussion:** The pre-exercise and post-exercise values of the cricket players were pooled and differences were determined by using the Kruskal - Wallis test. Significant differences was seen when comparing pre- and post-exercise values (sportsvision tests) between the three groups.

53. PHYSIOLOGICAL RESPONSE OF ELITE CRICKET PLAYERS DURING RESPECTIVE PHASES OF PLAY

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This study determined the "on-field" physiological response of fifteen elite cricket players (age 24,08 ± 0,8 years) during batting, fielding and bowling using an Aerosport KB1-C portable gas analyzer. The heart rate (b/min) during fielding (150.2 ± 14.8) and batting (136.5 ± 14.2) did not differ significantly ($p>0.05$) but were significantly higher ($p>0.001$) than spin-bowling (91.5 ± 16.0) and fast-bowling (113.3 ± 20.4; $p>0.05$) while the latter was significantly higher ($p>0.05$) than for spin-bowling. The metabolic equivalents measured during fielding (6.1 ± 1.5), batting (5.6 ± 2.7), fast-bowling (4.6 ± 1.3) and spin-bowling (4.0 + 2.1) did not differ significantly ($p>0.05$) as was the case for VO2 (ml/kg/min) measured during fielding (21.4 + 7.4), batting (18.8 ± 5.3), fast-bowling (16.6 ± 4.6) and spin-bowling (15.4 ± 7.4). The respiratory quotient measured for fielding (1.10 ± 0.2) was significantly higher ($p>0,05$) than for spin-bowling (0.86 + 0.1) but not significantly higher ($p>0.05$) than fast-bowling (0.99 ± 0.1) or batting (1.11 ± 0.04). In conclusion, exercise intensity and energy cost of the respective phases of play in cricket is moderate to heavy and carbohydrate is the most important fuel source utilized.

54. THE INFLUENCE OF UPPER BODY CONCENTRIC ACCELERATION TRAINING ON PERFORMANCE IN CRICKET PLAYERS.

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The purpose of this study was to determine whether or not maximum concentric acceleration for upper-body weight training would improve strength, power, bowling speed and throwing distance to a greater extent than conventional weight training during the pre-season for cricketers. Fourteen trained cricket players were recruited for the study with an average age of 20 years and busy preparing for the forthcoming season. They were randomly assigned to two groups, the control or the experimental group. Performance was measured by testing 1RM bench press strength, 1RM pull-over strength, 2 min maximal push-ups, maximum pull-ups, average throwing distance, maximum bowling speed and isokinetic flexion/extension performance of the shoulder region (using the Cybex 6000 isokinetic testing equipment). During the training program the experimental group executed al the exercises with maximum concentric movements. Pre- and post-test values indicated that the experimental group's average improvements were better than the control group. (Experimental vs. control group average improvements: 16% - 21%). It is concluded that by following the specific training program proposed in the study, a cricket player can achieve the advantages of establishing a good power base during the pre-season.

55. THE TRANSFER EFFECT IN EYE-HAND COORDINATION SKILLS FROM THE RIGHT TO THE LEFT CEREBRAL HEMISPHERE.

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Objectives: To determine whether an interhemispheric transfer effect of performance in eye-hand co-ordination skills exists. **Method:** A total of 55 subjects, 14- 17 years of age, participated in the study. The eye-hand co-ordination skills of the participants were tested using the right hand. These skills were practiced for a period of 5 weeks, after which the right hand was re-evaluated. The control group was tested before and after the practice period. The apparatus used, are grouped under the sports vision battery and test the different components of eye-hand co-ordination. **Results:** The median values obtained indicated an over-all increase in the experimental group results and a decrease in the control group results. The resultant p-values showed the study to be statistically significant. **Conclusion:** The results confirmed the existence of a transfer effect.

56. CALCULATING AN AEROBIC ENDURANCE TRAINING INTENSITY FOR CRICKET PLAYERS IN THE OFF-SEASON .

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The purpose of this study was to determine an aerobic endurance training intensity (expressed as a percentage of maximum measured heart rate) for cricket players during the off-season by using maximal oxygen uptake, heart rate and blood lactate values as parameters. Twenty elite young male cricket players (representing different provincial teams) with an average age of 22 and busy with their off-season training were recruited for this study. A direct running VO_2 max, using a progressive incremental running protocol, was used to determine heart rate, maximal oxygen consumption and blood lactate values at different workloads. By using heart rate, blood lactate and oxygen consumption as indicators, a general aerobic training intensity of 82% of maximal heart rate was calculated. Utilising this specific aerobic training intensity in the off-season a cricket player can achieve the advantages of a good aerobic fitness base without putting undue stress on the body and thus minimising the risk of injury.

57. EXERCISE ALTERS EMOTIONAL BEHAVIOUR OF CHILDREN WITH ATTENTION-DEFICIT HYPERACTIVITY DISORDER

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Background: Attention Deficit Hyperactivity Disorder (ADHD) is the leading childhood psychiatric disorder in America, affecting approximately 3-5% percent of children. Treatment involves psychosomatic drug intervention. Anecdotal reports from parents and teachers have suggested that exercise is beneficial for children with ADHD and may assist with treatment. **Aim:** This study investigated the effect of exercise on the behaviour of ADHD children. **Methods:** Twenty-one children (5-13 years) were recruited for the study. Fifteen participated in a five-week exercise programme (five days a week, 20 minutes of aerobic exercise per day at 50-75% of maximal heart rate). Six children acted as the controls and did not exercise. A modified Conner's Parent's Behavioral Rating Scale was used to rate behaviour pre-, during, and immediately post the five-week period. The scale included questions, which assessed attention, task orientation, emotional, motor skills, and oppositional behaviour. Ratings over the three assessment periods were compared using a repeated measures-multivariate analysis. **Results:** There was a significant improvement ($p = 0.047$) in the emotional behaviour after five-weeks of exercise. There was no change in the control groups' behaviour. **Conclusions:** These preliminary findings suggest that, participation in an aerobic exercise programme, five days a week for five weeks, may improve the emotional behaviour of ADHD children. Future studies should investigate whether a longer exercise programme will improve ratings in the other behaviour categories.

58. ANTHROPOMETRIC MARKERS OF BLOOD PRESSURE AMONG 10 - 15 YEAR OLD CHILDREN : THUSA BANA STUDY.

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Aim: The aim of this study was to determine which anthropometric indicator is the best marker of blood pressure in 10 - 15 year old children. **Methods:** A one-time cross sectional experimental design was used for this study. A total of 605, 10 - 15 year old males and 640 females were recruited from 44 randomly selected schools in the Northwest Province, which formed part of the THUSA BANA study during 2000 and 2001. Anthropometric measurements selected, were primarily those described in Norton and Olds (1996). Blood pressure was measured with the Finapres in a non-invasive way. Data analysis was performed using Statistica 2001 (Stat Soft., Inc) for Windows 98. A forward stepwise discriminant analysis was performed to determine which anthropometric indicator is the best marker of high systolic and diastolic blood pressure in 10 - 15 year old children. **Results and conclusions:** According to the results of the discriminant analysis, percentage body fat were the best marker of both high systolic and diastolic blood pressure followed by triceps skinfold and abdominal girth. Prediction models for high systolic and diastolic blood pressure were developed for males and females, using the results of the discriminant analysis. This prediction models had an overall accuracy of 89.25% of predicting high systolic blood pressure and a 90.91% overall accuracy of predicting high diastolic blood pressure.

59. OBESITY, BLOOD PRESSURE AND PHYSICAL ACTIVITY AMONG 10 - 15 YEAR OLD CHILDREN : THUSA BANA STUDY

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Aim: The primary purpose of this study was to investigate the relationship between blood pressure and measures of obesity in 10 - 15 year old children in the Northwest Province of South Africa. The secondary aim was to determine the influence of physical activity on the possible relationship between blood pressure and obesity. **Method:** A one-time cross sectional experimental design was used for this study. A total of 605, 10 - 15 year old males and 640 females were recruited from 44 randomly selected schools in the North-West Province, which formed part of the THUSA BANA study during 2000 and 2001. Demographic data and physical activity participation data were obtained through standarised questionnaires. Anthropometric measurements selected to determine percentage body fat, were primarily those described in Norton and Olds (1996). Blood pressure was measured with the Finapres in a non-invasive way. Data analysis was performed using Statistica 2000 (Stat Soft., Inc) for Windows 1998. One-way (ANOVA) and two-way analysis of variances together with Tukey post hoc HSD tests were used to indicate the differences between variables. The level of significance was set at $p<0.05$. **Results and conclusions:** Percentage body fat was not significantly associated with blood pressure for both males and females in analysis of variance. Although there were no statistically significant differences between percentage body fat and blood pressure, there seemed to be a trend that for systolic and diastolic blood pressure to increase with an increase in percentage body fat, both in the male and female groups. Two-way analysis of variance showed that physical activity had no significant effect on the relationship between percentage body fat and blood pressure.