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The **British Journal of Sports Medicine** is published quarterly by Butterworth-Heinemann Limited on behalf of the British Association of Sport and Medicine, Editorial Office, Butterworth-Heinemann, 59/60 Grosvenor Street, London W1X 9DA, UK. Tel: 071-493 5841 x395, Fax: 071-499 3384, Telex: 27278. Reprints, Butterworth-Heinemann, Linacre House, Jordan Hill, Oxford OX2 8DP, UK. Tel: 0865-310366, Fax: 0865-311268, Telex: 83111 BHPOXFG. Registered office: Butterworth & Co Limited, 88 Kingsway, London WC2 6AB, UK.

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Annual Subscription to the **British Journal of Sports Medicine** (4 issues):
UK £65.00.
Europe £70.00.
North America and rest of world £75.00.

Some **Back issues** prior to the current volume are available from: Dr Henry Evans Robson, 43 Westfield Lane, Rothley, Leicester LE7 7LH, UK.

US mailing agents: Second class postage paid at Rahway, NJ, USA. Postmaster: Send address corrections to **British Journal of Sports Medicine**, c/o Mercury Airfreight International Ltd, 2323 Randolph Avenue, Avenel, NJ 07001, USA, for further details.

ISSN 0306-3674 CODEN: BJSMDZ

PART OF REED INTERNATIONAL BOOKS

Composition by Genesis Typesetting, Laser Quay, Rochester, Kent.
Printed by the Friary Press, Dorchester, UK, and Cambridge University Press, Cambridge, UK.

From the journals

Sports medicine current awareness service

Prepared by Kathryn Walter and Nancy Laurenson at the London Sports Medicine Institute (LSMI) Library

The following summaries are taken from a selection of recent journals indexed in the LSMI database. A full listing is published monthly in *Sports Medicine Bulletin*.

Copies of the complete articles are available (price 15p per sheet subject to copyright law) from the Library, LSMI, c/o Medical College of St. Bartholomew's Hospital, Charterhouse Square, London EC1M 6BQ, UK. Tel: 071-251 0583.

Handweights have become an increasingly popular addition to aerobic exercise regimens such as walking, jogging and aerobic dance. In this review article, **Physiological effects of exercising with handweights** (Auble TE and Schwartz L. *Sports Medicine* 1991; **11**(4): 244–56), the literature suggests mixed results concerning the effects of handweights on the energy cost of exercise. The somewhat ambiguous findings could in part be attributed to variations in the combination of walking or running speed and handweight used, as well as variations in arm movement patterns. However, most research demonstrates a positive and graded relationship between handweighted exercise energy costs, the distance through which the handweights are swung and the weight used. The use of handweights can convert lower limb dominated endurance training modalities to exercises that simultaneously challenge the upper limb. The prescription of handweighted exercise is generally safe; however, for those individuals with cardiovascular complications such as elevated blood pressure, precautions should be emphasized. Potential strength and endurance training adaptations to handweighted exercise that incorporates large arm and leg range of motion movement patterns have yet to be determined.

A recent review **Age, drug, and exercise interactions in the treatment of hypertension** (Lowenthal DT, Pollock ML and Paran E. *Annals of Sports Medicine* 1990; **5**(4): 181–90) discusses the physiological and pathological haemodynamic changes related to exercise and ageing. The authors state that, while there is no ideal antihypertensive agent, incorporating an aerobic exercise programme three times per week for 30 min has been shown to lower mean blood pressure by 15/8 mmHg. Weight loss, cessation of smoking, reduction in alcohol intake and reduced salt are other well accepted, non-pharmacological modalities. Although dynamic physical activity may lower blood pressure, the change is often moderate and thus, drug therapy must often be considered as the standard form of antihypertensive treatment. This article discusses the use of diuretics, central α-agonists, β-blockers, vasodilators, angiotensin converting enzyme inhibitors and calcium antagonists as an aid to lowering blood pressures with respect to acute exercise and endurance training.

Injury and persistent reinjury to the hamstring muscle group is the most frequent and disabling musculotendinous strain that occurs in the sprinting athlete. The purpose of the study by T.W. Worrell and colleagues (**Comparison of isokinetic strength and flexibility measures between hamstring injured and noninjured athletes**. *Journal of Orthopaedic and Sports Physical Therapy* 1991; **13**(3): 118–25) was to determine whether bilateral differences existed in several quadriceps and hamstring strength indices and reciprocal muscle group ratios (concentric and eccentric) between subjects with a history of hamstring injury and subjects free from previous injury to this same muscle group. An additional purpose of this investigation was to determine the relationship of hamstring flexibility to hamstring muscle injury. Thirty-two young highly trained male athletes involved in 'high risk' hamstring injury sports were tested. Analysis of variance indicated that within the hamstring injured group the injured extremity was significantly less flexible than the non-injured extremity and the hamstring injured group was less flexible than the non-injured group. No significant strength differences existed between the hamstring injured and non-injured groups on any isokinetic measure evaluated. Thus, data in this study support the finding that lack of hamstring flexibility is the single most important characteristic of the hamstring injured athlete – not hamstring strength or hamstring: quadriceps muscle group ratio. As 81% of hamstring injured subjects reported that they performed stretching exercises, perhaps their technique should be evaluated!

Medicine and Science in Sports and Exercise (1991; **23**(3): 273–97) has recently published the proceedings from a clinical symposium which looks at obesity. The papers discuss in detail new developments concerning the factors which predispose towards obesity, as well as new treatment and therapy for the obese patient. In the first paper, **Diet composition, energy expenditure, and nutritional status in relation to obesity in men and women**, W.C. Miller challenges the generally accepted scientific view that adipose tissue accumulation is simply due to a disequilibrium in energy balance, resulting from energy intake exceeding energy expenditure. Treatment of obesity thus usually focuses upon reducing the total number of calories consumed in order to create a negative energy balance. However, the research presented in this review supports the conclusions that there are other factors that shift the balance between energy expenditure, favouring either body fat deposition or metabolism. These include: 1) obesity is not necessarily caused by overeating; 2) diet composition may be just as important as diet energy content in the promotion or reduction of obesity; 3) weight cycling through energy-restrictive dieting may lead to an increased difficulty to lose weight and a facilitated ability to regain body

weight; and 4) optimal weight loss may be achieved through a combination of reducing dietary fat intake and increasing complex carbohydrate and fibre consumption with minimal restrictions in total energy intake. In **Heredity and the path to overweight and obesity**, Claude Bouchard addresses the role of inherited factors in the development and maintenance of obesity. It is increasingly recognized that there are inherited differences in the susceptibility to become overweight or obese under given behavioural and lifestyle conditions. Based on twin and parent-child data, it has been reported that the heritability of resting metabolic rate, thermic response to food and energy cost of submaximal exercise, adjusted for the proper concomitants, is as high as 40%. The level of habitual physical activity also exhibits a significant heritability level in the order of 25%. The most important factor identified thus far to account for the individual differences in response to long-term overfeeding is the proportion of fat *versus* lean tissue gained. The high gainers store energy permanently in the form of fat while the low gainers store relatively more in the form of lean tissue. In the final article, **Factors common to successful therapy for the obese patient**, the authors (J.P. Foreyt and G.K. Goodrick) suggest that it is difficult to state what is truly 'successful therapy' (assuming significant and lasting weight loss) as only a small fraction of those treated meet such a criterion for success. Thus, the majority of patients treated for obesity regain lost weight after treatment. An emphasis on exercise and prescribing more gradual changes in diet and exercise appears to be associated with better outcomes. It may be necessary to re-conceptualie obesity as a food dependency disorder not amenable to self-control strategies. Thus, not surprisingly, those individuals who report higher levels of social and therapeutic support tend to do better in weight-loss programmes.

Rheumatic fever is back – don't miss it is an interesting case report which has been well described by L. Tyler Wadsworth (*Physician and Sports medicine* 1991; **19**(4): 75–83). The incidence of rheumatic fever has been declining over the past four decades, however, there have been several recent outbreaks in the USA. The most common presentation has been joint involvement without clinical manifestations of carditis. In this case, an active 13-year-old girl came to a sports medicine clinic (three times in 7 weeks) complaining of joint pain. Because of a low index of suspicion, diagnosis was delayed. It was not until her third visit that a complete medical history, a high streptococcal antibody titre, and a throat culture positive for β-haemolytic streptococci indicated the surprising diagnosis of rheumatic fever. Often elusive, the diagnosis is based on criteria proposed by Jones (1965). Treatment is aimed at eradicating the streptococci and treating the inflammatory response and is usually followed by long-term prophylaxis.

In clinical as well as health club and health promotion centres, tests are commonly used to estimate $\dot{V}O_{2,max}$ as a way to classify an individual's aerobic fitness for either exercise prescription or training status. The accuracy of many of these methods have often been queried by physiologists and a recent study by Linda D. Zwiren and colleagues (**Estimation of $\dot{V}O_{2,max}$: a comparative analysis of five exercise tests.** *Research Quarterly for Exercise and Sport* 1991; **62**(1): 73–8) has challenged their effective use. The five tests examined included a 1.5 mile run (Cooper 1968); a 1 mile walk (Kline *et al.* 1987); a step test (McArdle *et al.* 1972) which looked at postexercise heart rate recovery, and two tests that use heart rate response while exercising on a bicycle ergometer (Astrand-Rhyming [1954] nomogram and the YMCA extrapolation protocol). The subjects included 40 healthy female volunteers aged 30–39 years whose activity level ranged from low-level leisure-time activity to well-trained endurance athletes. Both the run and walk tests showed a high correlation to the measured $\dot{V}O_{2,max}$ with a similar mean estimated $\dot{V}O_{2,max}$ and standard deviation and low standard error of estimate. In contrast, using heart rate at a fixed submaximal cycle ergometer power output to estimate $\dot{V}O_{2,max}$ produced mean estimates that significantly overpredicted $\dot{V}O_{2,max}$ (standard error of the mean = 13% of the mean). The accuracy of predicting $\dot{V}O_{2,max}$ from heart rate determined at submaximal work levels may be limited by one or more assumptions: 1) linearity of heart rate oxygen uptake relationship; 2) accuracy of age-predicted maximal heart rate; 3) constant oxygen cost of external work on cycle ergometer; and 4) day to day heart rate variation.

Easy-listening and slow, or upbeat and fast? The effects of different music types on heart rate (HR), rating of perceived exertion (RPE) and time to exhaustion during treadmill exercise were determined on 24 volunteer college students in a study by B.L. Copeland and B.D. Franks (**Effects of types and intensities of background music on treadmill endurance**, *Journal of Sports Medicine & Physical Fitness* 1991; **31**(1): 100–3). Subjects participated in three randomly assigned multistage treadmill walk/run protocols to exhaustion while wearing a headset. The three treatments were: loud, fast, exciting, popular music; soft, slow, easy-listening, popular music; and no music (control). HR was recorded every 30 s until voluntary exhaustion. RPE was obtained after the test for five different points during the test. Students listening to low intensity music had a slightly lower HR, longer time to exhaustion and lower RPE during moderate work, providing some support for the hypothesis that soft, slow music reduces physiological and psychological arousal during submaximal exercise and increases endurance performance.

Changes in surgical techniques and postoperative treatments have led to modifications in rehabilitation protocols following anterior cruciate ligament repair/reconstruction. Articles in a recent issue of *Athletic Training* describe two such programmes. In **Knee rehabilitation following anterior cruciate ligament repair/construction: an update** (Case JG, DePalma BF and Zelko RR, *Athletic Training* 1991; **26**(1): 22–31) a 40-week rehabilitation programme based on research, closed kinetic chain principles and clinical experience for student athletes is detailed. Salient parts of the programme include the emphasis on early quadriceps strengthening and the need to maintain terminal knee extension. Isokinetic testing is delayed until at least 28 weeks after 4–6 weeks of isokinetic strength training. Subjective functional testing (carriage, control and confidence) is also employed to evaluate the athlete's progress. A more aggressive protocol is described in **Rapid rehabilitation following anterior cruciate ligament reconstruction** (Blair DF and Wills RP, *Athletic Training* 1991; **26**(1): 32–40). In contrast to the above programme, continuous passive motion begins immediately following surgery. Passive extension/flexion, stationary bicycling, muscle stimulation and a series of heavy rubber tubing exercises are started 5–7 days after operation. Emphasis is placed on closed kinetic chain activities (leg press, quarter squats, etc.) and proprioceptive exercises as the rehabilitation progresses. Light agility activities and jogging may be started at 6 weeks when the involved extremity reaches 70% of the uninvolved extremity on high speed isokinetic testing. Sports specific drills and a more intensive strengthening programme follow in a progressive manner.

A new code of practice for diving into swimming pools and a leaflet warning of the dangers of diving should help reduce the number of

diving related spinal injuries in the UK, according to a recent editorial in the *British Medical Journal* (**Diving into the unknown** March 1991; **302**, 23: 670–1). In 1988 and 1989 at least 60 patients were admitted to spinal injuries units with tetraplegia as a result of diving injuries; almost half these injuries occurred in swimming pools, about one-third in the sea and the remainder in rivers, lakes or ponds. The majority of victims were young and male. Most injuries occur when the head strikes the bottom of a pool, the sea or river bed or hits a submerged object such as rock. The bony injury resulting is nearly always a crush fracture of a lower cervical vertebra, usually C5, associated with retropulsion of the vertebral body and direct injury to the spinal cord. A concerted prevention campaign should be aimed particularly at young people, the aims being to increase awareness of the danger of diving into water of shallow or unknown depth, to teach the new diving code and to warn of the danger of overconfidence and of diving under the influence of alcohol.

The manifestation of stress in the body may increase the potential for injury as well as having negative effects on performance. Stress management through the practice of relaxation techniques is thus becoming established as a prerequisite for enhanced performance and injury prevention (**Stress management for athletes**, Wilks B, *Sports Medicine* 1991; **11**(5): 289–99). In addition to reductions in oxygen consumption and blood lactates, athletes trained in relaxation enjoy increased freedom of movement and coordination. Coping techniques currently in use include: relaxation response, stress inoculation training, biofeedback, meditation, counselling by sport psychologists, yoga, deep muscle relaxation, autohypnosis, visualization, breath control and time management. Not all have been found to be desirable for athletic use. Because the stress response is thought to have physiological as well as behavioural, cognitive and sociological aspects, relaxation training that is multidimensional is recommended.

Analysis of deaths from sports and leisure activities in England and Wales during 1982–1988 found that horse riding (98), air sports (92), motor sports (86) and mountaineering (74) were the most hazardous activities. (**Do we pay too dearly for our sport and leisure activities? An investigation into fatalities as a result of sporting and leisure activities in England and Wales, 1982–1988**, Avery JG, Harper P and Ackroyd S, *Public Health* 1990; **104**(6): 417–23). The most hazardous and fatal activity for children was horse riding (19). The commonest activities resulting in drowning in adults were swimming (128) and fishing (82). The main drowning deaths in children followed swimming (24). When exposure was taken into account, mountaineering, motor sports and horse riding were found to be the most hazardous activities. Mountaineering was one hundred times more dangerous than ball games or water sports. Strict control, sensible safety precautions and adequate training are paramount if we are to see any improvement.

A paper by Keld Kjeldsen suggests K^+ release from working skeletal muscle may exceed the capacity of the Na, K-pump leading to significant increases in both interstitial and plasma concentrations of K^+. Major fluctuations in plasma potassium may be associated with serious heart arrhythmias and sudden death (**Muscle Na, K-pump dysfunction may expose the heart to dangerous K levels during exercise**, *Canadian Journal of Sports Science* 1991; **16**(1): 33–9). A training-induced increase in catecholamines may mediate a reduced rise in plasma potassium during exercise, *via* a mechanism involving increased activation of Na, K-pumps. This enhanced K^+ clearance capacity associated with training may have its negative side, however (**Potassium and overtraining** (Editorial), Hicks A.L., *ibid* 7–8). On the one hand, training will diminish the exercise-induced rise in plasma K^+, thus reducing the risk of cardiac arrhythmia due to hyperkalaemia. On the other hand, the increased activity and/or efficiency of the Na, K-pump system after training may predispose one to a potentially dangerous hypokalaemic state immediately post exercise. Clearly, more research should be directed at examining K^+ homeostasis with chronic training. Moreover, the presence of underlying cardiac disease, often asymptomatic, will further increase the danger associated with any perturbations in the control of plasma K^+ in both trained and untrained individuals.

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BASM's current annual programme of Sports Medicine courses includes two introductory courses following the FIMS basic course outline and six advanced courses in physiology (cardiorespiratory), physiology (musculoskeletal), injury (head, neck, back and trunk), injury (lower limb), injury (upper limb), and advanced medicine of PE and sport.

All details from: BASM Education Officer, c/o LSMI, St. Bartholomew's Medical College, Charterhouse Square, London EC1M 6BQ, UK. Tel: 071-253 3244; Fax: 071-251 0774

Date	*Course*	*Venue*
March 1–3	Advanced Medicine of Physical Exercise and Sport	LSMI
April 12–14	Advanced Physiology Module: Cardiorespiratory System	British Olympic MC, Harrow
April 21–26	BASM Introductory Sports Medicine Course	Lilleshall
May 17–19	Advanced Injury Module: Upper Limb	Crystal Palace NSC
June 14–16	Advanced Injury Module: Chronic and Overuse Injuries	Hillingdon Hospital, Middlesex
September 29–October 4	BASM Introductory Sports Medicine Course	Lilleshall
November 8–10	**BASM 1991 Annual Congress, sponsored by Lederle Laboratories. Details from: John Clegg, Birch Lea, 67 Springfield Lane, Eccleston, St. Helens, Merseyside WA10 5HB, UK. Tel: (0744) 28198**	**Low Wood Hotel, Ambleside, Windermere**

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21 Sperryn, P.N. *SpoA and Medicine* Butterworths, UK 1983
22 Ellitsgaard, N. and Warburg, F. Movements causing ankle fractures in parachuting. *Br J. Sports Med* 1989, **23**, 27–29

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