

Medical aspects of exercise

Benefits and risks

SUMMARY OF A REPORT OF THE ROYAL COLLEGE OF PHYSICIANS

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There is general agreement that for the majority of the population the amount of physical activity which they undertake has greatly decreased in recent years. A consensus as to the consequences of this inactivity in the development of some diseases or the benefits of exercise in various disorders is less easy to achieve.

In an attempt to produce a balanced view from the information currently available, this report assesses some of the evidence for the benefits and risks of exercise.

The report looks first at the basic physiology of exercise and the physiological changes that follow regular exercise. Succeeding chapters are concerned with the effect of exercise in the prevention and treatment of various diseases, with additional sections referring to the special problems of children and the elderly. Finally, the risks of physical exercise are assessed.

Basic physiology and changes following regular exercise

The physiology and metabolism of aerobic and anaerobic exercise are described in the report. Anaerobic energy sources mask the ability of those with a sedentary life-style to sustain, beyond a short-time, many forms of physical activity; such people are thus unaware of their limited capacity. Figures based on data from the Canada Fitness Survey are used to illustrate the level of exertion experienced by men in different age groups walking uphill or on the level. Walking uphill at about 3 mph is shown to tax severely the average man over the age of 35 years. A reference to the Welsh Heart Study supports these findings.

Table 1 gives examples of the comparative energy expenditure of some common physical activities.

All regular exercise has a training effect which can reverse the physiological and biochemical changes caused by inactivity. The structure of muscle adapts with changes in the size and strength of the cells and their enzymes as well as in the number and size of the capillaries with consequent improved oxygen supply and extraction. These changes result in a slower heart rate and hence decreased work by the heart for any level of effort with benefits of a reduced myocardial oxygen demand and increased exercise tolerance.

Other sections look at the consequences of exercise on the lungs, bone, joints and tendons, bowel, endocrine system and metabolism. There is generally good evidence that the changes following exercise result in improved structure or function.

Exercise and disease

The report provides strong evidence that regular exercise, as well as improving the capacity for physical effort, has a variety of favourable physiological consequences which may delay the onset of some diseases and be of potential therapeutic benefit when the disease has developed. Data, whether epidemiological or based on other studies, are however often conflicting or capable of differing interpretations and can make difficult the assessment of the value of exercise in the prevention or management of disease. A further problem arises in obtaining information as to what type or level of exercise is required where a therapeutic effect

Table 1. Comparative energy expenditure of common physical activities.

Activity	Energy expenditure (mlO ₂ /kg/min)	Calorie consumption (kcal/h)*	METS†
Driving a car	4	80	1.1
Sitting (desk work)	4	80	1.1
Standing (relaxed)	5	100	1.4
Standing. Light work: cooking etc	9	180	2.6
Scrubbing, polishing	10	200	2.9
Assembly line work	12	240	3.4
Walking at 5 km/h	13	260	3.7
Walking. Moderate work: carrying trays, dishes	15	300	4.3
Heavy arm work: lifting and carrying 10–20 kg	16	320	4.6
Cutting trees, chopping wood	19	380	5.4
Walking at 7 km/h	21	420	6.0
Walking uphill (1 in 7) at 6 km/h	24	480	6.9
Heavy arm work: lifting and carrying 38–45 kg	30	600	8.6
Running at 9 km/h	30	600	8.6
Swimming (crawl 50 m/min)	42	840	12.0
Cross-country skiing (competitive)	70	1440	20.0

*Calculated for 70 kg person.

†METS = multiples of resting metabolic rate.

has been shown. In the various disorders studied, the report has, where possible and appropriate, drawn attention to these difficulties.

Cardiovascular disease

Regular exercise can produce elevation of HDL cholesterol, increased fibrinolysis, improved glucose tolerance and a reduction in arterial pressure of up to 16/11 mmHg. Physical inactivity is associated with an increased incidence of coronary disease and, while recognising the problem of self-selection and the influence of other risk factors, analysis of surveys shows that exercise offers protection against coronary disease. When physical activity is continued protection does not diminish with time.

A unanimous view does not exist as to whether there is a graded benefit with increasing levels of exercise or whether a critical amount of activity is required before benefit is produced. Quoted thresholds include an additional activity level of 2000 kcal per week (five hours very brisk walking) or twice weekly vigorous aerobic activity involving peaks of energy expenditure of around 420 kcal/h (>6 METS).

In the treatment of cardiovascular disease, benefit may result from the reduction in heart rate and hence of myocardial oxygen demand for a given level of activity following the training effect of regular exercise. Formal post-infarction physical training programmes have much to recommend them in the rehabilitation of patients. Meta-analysis of major studies concludes that physical rehabilitation does reduce mortality. Traditional views about the avoidance of physical exercise in heart failure are also now being questioned with evi-

dence of haemodynamic benefit following an appropriate programme.

The risk of exercise-provoked arrhythmias necessitates care in the selection of patients for the exercise programmes.

For patients with peripheral vascular disease there is good evidence that regular physical activity will reduce the symptoms of intermittent claudication.

Exercise and respiratory disease

Most asthmatics benefit from exercise despite little change in objective measurements of lung function. The benefits of exercise for asthmatic children, particularly swimming, are noted. Children with cystic fibrosis also may improve with physical exercise. In patients with chronic bronchitis and emphysema formal training programmes have shown increased exercise tolerance with endurance improving rather than maximum work rate.

Exercise and the musculo-skeletal system

While excessive or inappropriate exercise may cause tissue injury or permanent damage there are many benefits from physical activity. Muscle becomes stronger and more resistant to fatigue, ligaments and tendons and their attachments are strengthened, bone becomes stronger and the nutrition of articular cartilage is improved. The stability of joints is also influenced by the state of the surrounding ligaments and musculature. The report assesses the influence and place of exercise in various degenerative or inflammatory conditions of the locomotor system.

Effect of exercise on bone and the reproductive system

Physical inactivity is one of the factors in the development of osteoporosis. Physical activity increases bone metabolism and bone mass before and after the menopause with a resultant delay in reaching the 'fracture threshold'. The extent and type of exercise to be undertaken is not established, although antigravitational stress should probably be involved.

Menstrual irregularity is more common in women who are athletes. Menstrual and ovulatory dysfunction is affected by a number of factors including the degree of previous training, extent of exercise and weight loss. Delayed puberty, amenorrhoea and infertility may occur but are normally reversible and are not usually seen with moderate exercise. Amenorrhoeic athletes have lower bone mineral content.

Sensible exercise during pregnancy is not contraindicated.

Exercise in the control of diabetes and obesity

Insulin sensitivity increases with exercise and glucose tolerance in normal people correlates with their presumed level of physical activity. Exercise improves blood glucose and glycosylated haemoglobin levels in Type II but not Type I (insulin dependent) diabetics. Attention is drawn to the obvious risks of hypoglycaemia with exercise.

In obesity the place of exercise is secondary to dietary management. Regular aerobic physical activity increases energy consumption both during the period of exercise and for several hours afterwards. Moderately obese women, children and adolescents have been shown to lose more weight when undertaking an aerobic exercise programme and dietary restriction than control groups using dietary restriction alone. In the severely obese, exercise is probably of little benefit.

Psychological aspects

Regular exercise has a mood elevating effect and can help patients with mild depression and anxiety. While blood endorphin levels rise, the exact biochemical mechanisms occurring in the brain and producing the psychological changes related to exercise are unknown.

Exercise in childhood and the elderly

The psychological and medical benefits of exercise in various diseases seen in children such as asthma, renal disorders, muscular dystrophy and epilepsy are reviewed; in few is there an absolute contraindication, while the habit of regular exercise is most beneficial when acquired young. There may be hazards to young athletes from prolonged repetitive activity.

In the elderly, motor neurone depletion and disuse

cause loss of muscle bulk and power in addition to the changes in other systems. Appropriate exercise can increase muscle bulk and strength by 10–20% in men in their early seventies. Aerobic exercises such as walking and swimming will also have favourable effects on the other systems as previously outlined.

Risks of physical exercise

The benefits of exercise have to be balanced against the risks which are examined in the final chapter of the report.

Cardiovascular events during exercise, particularly ventricular fibrillation, are the main concern. Asymptomatic persons after a long period of inactivity should never embark abruptly on a course of vigorous exercise but should undertake an appropriate sport and improve their fitness steadily. Explosive exercise such as squash may be particularly dangerous in the untrained.

Those with cardiovascular or other symptoms should be assessed and advised by their own doctor before undertaking a course of exercise but detailed screening of the general population is impractical.

Some athletes who have trained for endurance events may show cardiac and ECG changes, and the risk of an incorrect diagnosis of organic heart disease based on these findings is emphasised. There is no evidence that highly trained individuals are at an increased risk of cardiac death in later life.

The risks of hyperthermia and hypothermia in some forms of exercise should be recognised.

Vigorous exercise is contraindicated in the presence of a viral infection.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

There is substantial evidence that regular aerobic exercise such as walking, jogging, dancing or swimming is beneficial to general physical and psychological health. Regular exercise appears to be particularly effective in prevention of coronary disease and osteoporosis and of some value in the management of obesity and diabetes. Remedial exercise can play a useful role in the management of a wide variety of musculoskeletal disorders.

It is important, where possible, to continue such activity beyond youth and middle age into old age. Since an interest in physical activity is most easily stimulated in childhood and youth, it is essential that its value is appreciated both by local education authorities and government.

Hazards of exercise appear to be substantially outweighed by benefits. Serious problems are usually encountered only when severe or unaccustomed exercise is undertaken and can usually be avoided by careful attention to the presence of warning symptoms.

Recommendations

1. There is now good evidence of many physical and psychological benefits available to the population from regular exercise which should be recognised by all those involved in health care. It is of particular value in the prevention of coronary disease and post-menopausal osteoporosis and has a useful role in weight control, the management of late onset diabetes and many musculo-skeletal disorders.
2. The habit of taking regular recreational exercise is best started in childhood and should be continued into middle age and where possible into old age because exercise helps to make the most of diminishing physical capacity. The provision of appropriate facilities has resource implications for the community.
3. Doctors should ask about exercise when they see patients, particularly when they come for routine health checks, and should be aware of and advise on suitable exercise programmes.
4. The value of exercise for patients with a wide range of disorders should be considered and advice given on the type and extent of activity to be undertaken.
5. Doctors should be aware of the relevant risks that exercise may pose for individual patients. In particular, they should warn against unaccustomed, severe or inappropriate activity. When exercise is of a suitable intensity for the individual, is taken regularly and with sensible precautions, the benefits greatly outweigh any risks.

The full report is available from the Royal College of Physicians. Price: £7.50 (plus 50p postage and packing).

Royal Colleges of Physicians MRCP (UK)

Part 1

The next MRCP (UK) Part 1 Examination will take place on Thursday, 3rd October 1991.

Application forms accompanied by the necessary certificates and fee of £150 must reach the College of entry by Friday, 23rd August 1991.

Prospective candidates should have been qualified for 18 months and may enter through any of the Colleges listed below.

Part 2

The next MRCP (UK) Part 2 Examination will begin on Tuesday, 10th September 1991.

Application forms accompanied by the necessary documentation and fees must reach the College of entry by Friday, 2nd August 1991.

Prospective candidates should have been qualified for 2½ years and must comply with the regulations concerning training in acute medicine.

Candidates are also advised that the Projected Material paper in the Written Section of this examination has been replaced by printed Photographic Material, covering the same range of subjects as described in the Regulations, page 10, section 1(c). There will be 20 compulsory questions (time allowed: 40 minutes).

The Examination fees: *Written Section* £145 *Oral and Clinical Section* £160. The London College will require separate cheques. The Scottish Colleges will require a single cheque for £305.

Royal College of Physicians of Edinburgh,
9 Queen Street, Edinburgh EH2 1JQ

Royal College of Physicians & Surgeons of Glasgow,
242 St Vincent Street, Glasgow G2 5RJ

Royal College of Physicians of London,
11 St Andrew's Place,
Regent's Park, London NW1 4LE.

Royal College of Physicians of London DIPLOMA IN GERIATRIC MEDICINE

The Diploma in Geriatric Medicine is designed to give recognition of competence in the provision of care for the elderly and is particularly suitable for General Practitioner vocational trainees, Clinical Assistants and other doctors working in non-consultant career posts in Departments of Geriatric Medicine, and other doctors with interests in or who have responsibilities for the care of the elderly.

The next examination will begin on 10th October 1991. Application forms, together with the necessary documentation, must reach the College by Friday, 30th August 1991.

Candidates must either have held a post approved for professional training in a department specialising in the care of the elderly, or have had experience over a period of 2 years since Full Registration or equivalent in which the care of the elderly formed a significant part.

Further details and an application form may be obtained from:

Examinations Office,
Royal College of Physicians of London,
11 St Andrew's Place,
Regent's Park, London NW1 4LE.