

Children combat heart disease



Can we do anything to reduce the incidence of heart attacks? Australia suffers one of the highest rates in the world. Men here run seven times the risk faced by men in Japan, and the death rate among Australian women is almost as high as that among the men.

By analysing the diets and habits of different populations, scientists have focused suspicion on several 'risk factors', such as smoking, high blood pressure, and obesity, and programs of health education aim at making adults aware of these factors.

But over the last few years researchers have been examining another possibility: that your chance of one day dying from a heart attack may be reduced if you adopt the right life style as a child, especially taking frequent vigorous exercise.

Because heart attacks kill few people under the age of 30, this idea will take several decades to test satisfactorily, but preliminary experiments with schoolchildren, initiated 3 years ago in South Australia by the State Education Department and the CSIRO Division of Human Nutrition, have already encouraged scientists to conduct a larger, nationwide experiment, and stimulated more than three-fifths of South Australia's primary schools to place daily exercise on their time-tables.



Before looking at the results of research conducted so far in schools, it may be as well to consider why vigorous exercise has attracted the attention of a growing number of scientists and doctors, and why children are coming under researchers' scrutiny.

Why exercise?

For about 30 years investigators have been looking for a connection between inactivity and coronary heart disease. By 1970 many researchers had come to the conclusion that exercise could reduce somebody's risk of dying from a heart attack by about 30%. This figure placed exercise rather low on doctors' lists of priorities.

By renouncing cigarettes, heavy smokers can cut their risk by half, and people with high blood pressure or a high level of cholesterol in their circulation can, if they lower these risk factors sufficiently, reduce their hazard by some 55%. So naturally doctors in the 1960s were channelling their preventive energies against these 'big three' risk factors.

Subsequent, more critical, research changed the picture. Earlier experimenters had investigated a wide range of activities, from a game of bowls to long-distance running. But exercise physiologists had found evidence that the heart

One test of fitness: taking a child's pulse as she pedals on a bicycle ergometer.

People taking only moderate exercise remain as prone to heart disease as people taking no exercise at all.

and lungs improved in performance only above a certain threshold of activity; to cross this threshold adults must raise their pulse rate to 120 or higher for at least a quarter of an hour three or more times a week.

Few of the experimental subjects in the early investigations ever exercised this vigorously.

Taking account of this concept of an exercise threshold, scientists took a fresh look at the facts. Two major studies, one involving 16 000 British public servants and the other examining more than 3600 longshoremen in San Francisco, both suggested that vigorous exercise, above the threshold level, reduced men's risk of a heart attack by 50-70%. Men whose exercise came into the moderate category, falling short of the threshold, remained as prone to heart disease as those who took no exercise at all.

Other studies showed that vigorous exercise mitigated the three main physiological risk factors: blood pressure, obesity, and the amounts of different types of lipoproteins (fatty compounds) in the blood. People who 'pepped up' their activity from moderate to vigorous became healthier on all three physiological counts.

Armed with this new insight, doctors added exercise to their preventive armoury. In one respect, vigorous physical activity now seems the most important prescription: more people stand to gain by throwing off their lethargy and pulling on their running shorts than can reduce their risk of heart disease by adopting or kicking any other single habit.

Of the age group considered 'at risk' (those aged 30-60), more than 90% in Australia fail to take exercise above the threshold level. This indolent majority far outnumbers any other single 'risk' group. Smokers come next; they make up 40% of the age group, three-fifths of them getting through 20 or more cigarettes a day. Hazardously high blood pressure or serum cholesterol levels affect fewer people.

Of course, there are other strong reasons for improving one's health, and in particular for giving up smoking, but if a doctor had to offer just one piece of advice



Measuring one of the four skinfolds.

The fitness group performed 'huff and puff' exercises such as vigorous dancing, which greatly raised the children's pulse rates.



to a large audience keen to avoid heart disease, he would probably tell them to take enough exercise to work up a light sweat and become breathless — every day.

Why children?

Coronary heart disease, like several other modern epidemics, belongs to the category of life-style diseases. In other words, your chance of becoming a victim depends at least in part on your everyday habits: your diet, whether you smoke, how much exercise you take, and so on.

Such habits begin to form in childhood, which therefore does not seem too early to tackle the risk factors, especially as a fair proportion of children in Australia are overweight and some — particularly in cities — regularly smoke cigarettes. A number of children have high blood pressure, too, and the hardening of arteries characteristic of heart disease afflicts some people before they are out of their teens.

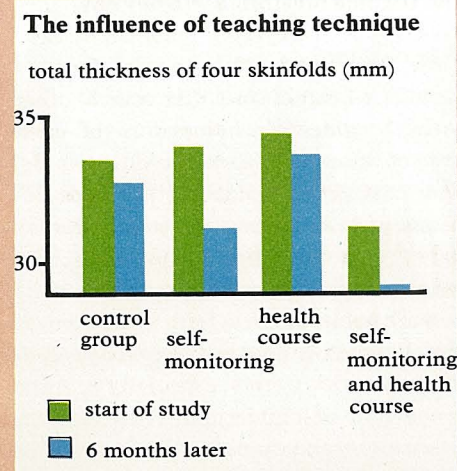
If boys and girls are to learn new habits, where better than in school? Some scientists would even argue that the education system has a moral obligation to see that children take adequate exercise. Children have to attend school, where they sit for much of the day and only rarely, if at all, engage in activities sufficiently vigorous to make them fitter. As one researcher put it, 'schools are health hazards'.

In short, many Australian children have unwittingly started along the road to an unhealthy middle age, in which their chance of dying from heart disease will be much greater than a healthy person's.

Can these unhealthy trends be reversed? Several overseas studies have suggested that children who take more exercise enjoy physical, psychological, and even academic benefits, but, before scientists can make precise recommendations on how to move boys and girls down the risk ladder, they need more precise information.

With this in mind, Mr Wayne Coonan of the South Australian Education Department's physical education branch joined forces in 1978 with Dr Terry Dwyer (now with the Commonwealth Institute of Health), Dr Tony Worsley, and Mr Don Leitch, of the CSIRO Division of Human Nutrition, to conduct an experiment involving more than 500 children, all in Grade 5 (about 10 years old). In each of seven primary schools, three classes took part.

One class, called the fitness group, performed 'huff and puff' exercises such as running, continuous skipping, and vigorous dancing, which greatly raised the



All these children did vigorous daily exercise, and, on average, every group slimmed. Children monitoring their own progress lost most body fat.

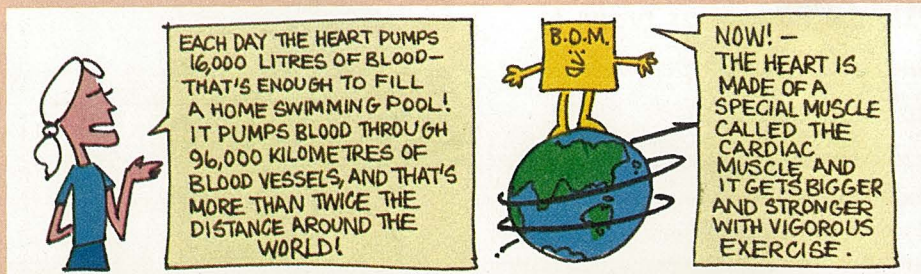
The success of a primary school fitness program must depend enormously on the attitude of the children taking part. During their initial survey in 1978, the researchers found that 10-year-olds, however unfit, simply did not think of themselves as unhealthy. On the other hand, the boys and girls showed great interest in learning how their bodies functioned.

Mr Coonan and Dr Worsley decided to investigate in more detail the ways in which both children and their parents think about health. In order to develop a more complete and — they hoped — more effective program, the researchers wrote a 'Body Owner's Manual', which stressed the importance not only of vigorous exercise, but of relaxation and a good diet, too.

The manual has played a key part in the 'body owner's program'. In this study, involving more than 500 students (700 in 1981), the researchers have been testing the effects of different teaching techniques on students already doing daily physical education.

In the first year, one category of children followed a special health course of two lessons a week for a year, using the 'Body Owner's Manual'; a second group monitored their own progress, both in physical activity and in modifying their diet; and a third group combined these treatments, both following the course and recording their own performances. A fourth group acted as controls, doing no more than daily physical education.

The program is supported by the Educational Research and Development Committee, the South Australian Health Commission, and CSIRO.



Getting the message across: an extract from the 'body owner's manual'.

From the results so far, it is clear that 'self-monitoring' students reduce their blood pressure and lose body fat more efficiently than students who accept both health information and daily physical education sessions more passively.

The self-monitors record their performances — how fast they run a set distance, for example, and what foods they eat — in a 'Body Owner's Service Manual', a booklet that suggests satisfactory standards, allows the student to choose a realistic personal goal, and translates performances into point scores.

This approach achieved such encouraging results in 1980, the first year of the program, that the researchers decided last year that all students following the special health course should also monitor their own progress.

All the signs so far indicate that children whose daily curriculum includes 50 minutes of physical exercise, including some vigorous activity, become fitter than those on a traditional time-table with perhaps three half-hour sessions a week of less strenuous exercise; and, of the children who exercise daily, those who monitor their own progress do best of all.

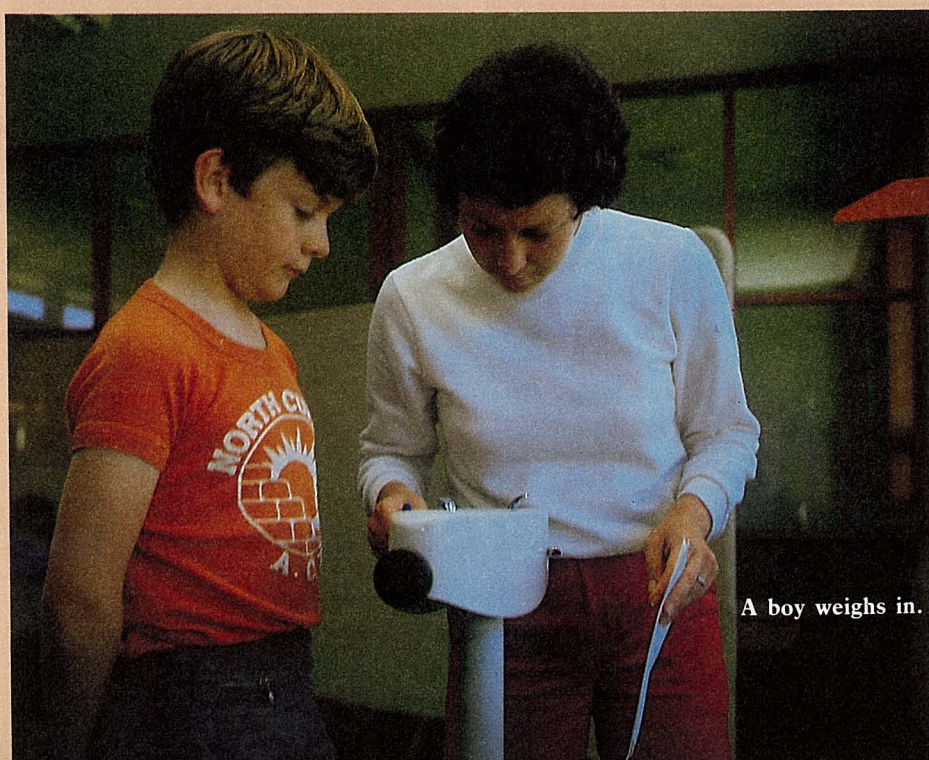
The self-monitoring students have shown about three times the improvement in fitness seen among children following the original 14-week daily exercise program in 1978.

Tests show that students using the 'Body Owner's Manual' learn more than other children about their bodies. This seems an important point; at the outset, questionnaires revealed, for example, that boys and girls equated fatty, sugary foods with good health.

The lively style of the manual and its cartoons — not to mention its vital information and advice — appeal not only to the young. 'We have trouble getting it back from parents sometimes', one researcher remarked.

Both parents and teachers have shown great interest in the body owner's program, and many parents have asked the schools to run health courses for them.

But the scientists have not discovered a panacea. Dr Worsley and Mr Coonan point out that a large proportion of the children they have studied so far remain relatively uninfluenced by the project, and researchers must now find ways to improve the fitness of these children.



children's pulse rates. A second class, the skills group, held additional sessions of normal physical education activities, such as games and dancing, designed to improve various skills without deliberately increasing heart rate.

The fitness and skills groups exercised every school day, for 15 minutes in the morning and an hour in the afternoon, for 14 weeks. The remaining class acted as a control, and carried on with its conventional time-table — incorporating only three half-hour sessions of traditional physical education, little of it vigorous.

At the outset, the investigators made a series of measurements on the children: height and weight; thickness of four skin-folds in different parts of the body, as an indication of body fat; blood pressure; various blood lipid fractions; and endurance fitness, measured using a bicycle ergometer, which is like an exercise bicycle designed to record a child's work output as he or she pedals.

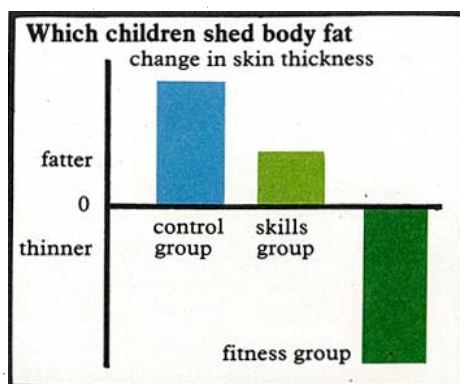
Every child also took reading, arithmetic, and psychological tests. Their teachers assessed the children's classroom behaviour using a scale on which every child was awarded a score on each of 18 items.

The results

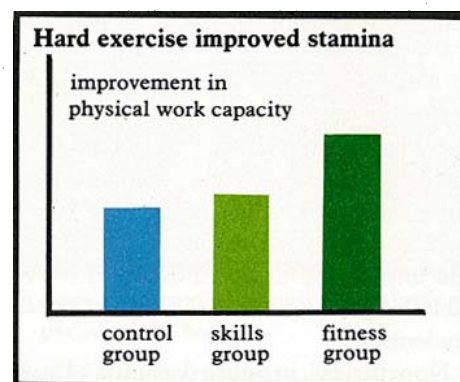
After 14 weeks on their various exercise routines, the children went through all these tests again, with the following results.

- ▶ The fitness group, and especially its overweight members, shed some body fat. The other two groups did not.
- ▶ The fitness group also improved their physical work capacity (their performance on the bicycle ergometer) by a larger margin than children in the other two groups.
- ▶ Blood pressure fell in the skills group. (In fact, the fitness children showed a drop too, but measured against the small fall shown by the control group, it was not statistically significant.)
- ▶ The reported school behaviour of both the skills and fitness groups improved more than did that of the control children. Parents' comments on the children's behaviour at home reinforced this finding.
- ▶ Academically, the children who gave up some of their lesson time to do exercises suffered no ill effects.

The scientists found no change in the levels of fats and cholesterol in the chil-



The 'fitness' group was the only one to show an average loss of body fat.



The children doing vigorous exercise ('fitness' group) improved their capacity for physical work by more than the other groups.

dren's blood, but this is not surprising. Only 80 children could be measured, and they started the program with 'healthy' levels; exercise seems in any case to exert a major effect on these levels only in older people.

Despite the extra time the skills group spent on 'phys.ed.', these children failed to improve their physical work capacity by any more than the controls. Clearly, not time but vigour improves fitness.

Parents and staff at the schools participating in this initial study felt so encouraged by the results that they decided to incorporate daily physical exercise in the curriculum. This gave the researchers an opportunity to study the effects of a prolonged program of activity, and in 1980 Mr Coonan, Dr Dwyer, and Mr Leitch returned to the schools and examined more than 200 Grade 5 children who had been exercising for 2 years.

Compared with the 1978 children at the start of their 14-week exercise program, these 1980 boys and girls turned out to be slimmer, and fewer were overweight. The 1980 group had a higher physical work capacity, too, and lower blood pressure, although only in boys did the fall in blood pressure reach statistical significance.

The exercise program that the 1980 children had been pursuing for 2 years

combined elements from both the original fitness and skills programs. Although the children performed well on the bicycle ergometer, their improvement over the 1978 group was less dramatic than the results achieved by the original fitness group in 14 weeks, and this may be explained by the smaller proportion of vigorous exercise in the 2-year program.

The researchers point out that a training program does not continue indefinitely to increase your physical work capacity; if the workload stays the same, the program produces almost all its benefits in the first 3 months. After that, you simply remain at your new level of fitness. Motivation may decline over a long period, too.

On the other hand, any exercise that raises your energy use above your intake will go on eating into your fat deposits over a much longer period. It seems this must have occurred during the 2-year program, as the 1980 children slimmed more than the 1978 group.

Unfortunately the researchers did not test one possible explanation for the 1980 results, namely that 10-year-olds throughout the community were for some reason slimmer and fitter than their predecessors of 1978. To eliminate the possibility, they needed a control group.

Since every school in the original 14-week project decided to carry on exercising, no 1980 control group existed. However, the researchers did find that in one school, which 'was generally regarded as being particularly rigorous in its adherence' to the program, the children lost more fat than in any of the others.

Many Australian children have unwittingly started along the road to an unhealthy middle age.

What about lessons?

Scientists still cannot say whether exercise affects a child's academic performance. Several Canadian studies have suggested that students who take some time off for physical activity show a scholastic improvement, but, as the schools involved volunteered to take part, the results perhaps reflected the participants' enthusiasm.

The South Australian study in 1980, like the one 2 years earlier, failed to find

an appreciable change in students' academic achievement. The children scored slightly better in arithmetic tests than the 1978 group had done, but the difference was not statistically significant.

While exercising may not propel boys and girls to greater scholastic heights, it seems not to handicap them either. Schools hesitating to adopt an activity program may find reassurance in the researchers' discovery that, even after 'losing' on average 45 minutes of teaching time every day for 2 years, 10-year-olds show no signs of having fallen behind in their subjects.

At the same time, the scientists concluded from these two studies that a daily exercise program brings substantial health benefits to children of this age.

The original study group continued to exercise daily, and in 1980 scientists examined the children, now averaging 12 years old. The results showed that, by adhering to the program, children could remain fitter and slimmer and so continue to enjoy the benefits of exercise.



In South Australia, where each school largely determines its own curriculum, many teachers soon decided that these benefits should be available to their students, and last year 303 of the State's 489 primary schools were running a daily program of both fitness and skills exercises for all their classes. Some of the other schools have been operating a less-complete program.

Although we must wait a long while, and scientists must carry out much more research, before knowing whether childhood exercise repays the effort with better adult health and longer life, enthusiasm for activity programs has quickly spread to other States. The Victorian Minister of Educational Services last year announced that daily physical education should, within the next few years, become part of the curriculum of every primary and secondary student in the State.

In Tasmania, itinerant physical education teachers help to ensure that about four-fifths of the schools take part in some form of daily activity. In the other States and Territories schools are showing increasing interest in exercise, but as yet relatively few have translated that interest into action. To do so requires not only

firm resolve from the staff but also technical assistance in setting up the program; this usually comes from advisers, but advisory services are being trimmed to cut costs.

Secondary considerations

The secondary schools face an additional problem: teachers' jealousy of the time allocated to their traditional academic subjects. A primary class may have the same teacher for all or most of the day, and if that teacher has the will to add physical exercise to the time-table, he or she will find a way.

But the secondary students' day is divided into more or less inflexible compartments, each allotted to a subject. The staff may collectively approve of introducing daily exercise, but what teacher is prepared to sacrifice the necessary lessons? Being so large, secondary schools also run into bigger logistic difficulties in establishing an activities program for all students.

Nonetheless, in South Australia 11% of the 145 secondary schools do run a full exercise program, and some others organize less-intensive schedules. Doubtless researchers will be interested to measure the effects of physical activity on secondary students' fitness and, perhaps, on adolescent attitudes.

One South Australian secondary school features in a nation-wide survey being funded by the Menzies Foundation and the South Australian Health Commission. This survey, being conducted by Mr Coonan and Mr Chris Daw, also of the Education Department, and Dr Basil Hetzel, Dr Worsley, and Mr Leitch, of the Division of Human Nutrition, extends the South Australian primary school investigation to the rest of Australia. In every State and Territory one experimental primary school, whose students perform daily activities for 20 weeks, has been matched against a control school.

If the results of this survey confirm those of the earlier studies, scientists may have made an important advance against Australia's number one killer: coronary heart disease.

John Seymour

More about the topic

An assessment of the effects of two physical activity programmes on coronary heart disease risk factors in primary school children. T. Dwyer, W. E. Coonan, A. Worsley, and D. R. Leitch. *Community Health Studies*, 1979, 3, 196-202.