Youth Support - Professional Training

Reprints - Series Two No 2

Sports Medicine - "The Training stresses for children and Young People"

Society of Public Health conference Manchester University 1989 Journal Ad Health and Welfare Vol2 No 3 1989. plus "Health and Excercise - the role of the school medical staff" and "Diet and Preparing for the Marathon" Society of Public Health - Members Newsletter. 1990

SPORTS MEDICINE

The Training Stresses for Children and Young People

Diana Birch September 1989

This article is a shortened version of a paper given at the Society of Public Health's Sport's Medicine Conference in Manchester University September 1989.

When I was first asked to talk about children in sport I knew that very little had been written about sports medicine and children, but it was only when I actually set out to research this paper that I realised what an almost total gap there is in the literature. It thus became obvious that I needed to pull together some of the information that we do have from the fields of paediatrics, developmental medicine and sports medicine and to provide some 'food for thought' as to how we should be tackling the growing problem of early training.

The child can be involved in a wide spectrum of sporting activities ranging from straightforward play

PLAY->INFORMAL->ORGANISED->COMPETITIVE->TRAINING
GAMES SPORT SPORT

and these can be in a variety of environments (hard concrete playground, swimming pool water etc) each posing particular tasks and strains on the developing body.

It is important to remember that the child's body is a developing body - the child is not just a smaller version of the adult. The body proportions are different producing engineering and mechanical differences; moreover these proportions are changing ..

When speaking of children in sport we must therefore consider the following:-

AGE - BONE AGE - EPIPHYSEAL FUSION
GROWTH - SIZE - WEIGHT - HEIGHT - PROPORTIONS
DEVELOPMENT - NEUROLOGICAL - COORDINATION
MATURITY - HORMONAL - PUBERTY
PSYCHOLOGICAL - MOTIVATION - INDEPENDANCE

In terms of age, bone age is more relevant than chronological age since not only does this indicate the state of fusion of epiphyses and thus the vulnerability of joints and bones to particular types of injury, but bone age gives us a better yardstick for developmental stages. For instance a female gymnast aged 14 with no periods might raise the question of delayed puberty due to overtraining and weight loss, however if we knew her bone age was only 12 this would be in favour of a constitutional later development.

Generally speaking young people are involved in a variety of sporting activities so the particular stresses of one type of training will not be disproportionate. The following list of presentations of a schoolboy in a school year clearly illustrate this diversity.

CONJUNCTIVITIS - SWIMMING POOL
GRAZED KNEE - SKATEBOARDING
BLACK EYE - RUGBY
CUT CHIN - DIVING
HEAD INJURY - CYCLING
ASTHMA - CROSS COUNTRY RUN

Children who specifically train for one sport are thus placed in an artificial situation when possibly one group of muscles or one type of movement is exaggerated. Thus normal developmental patterns can be altered.

A great exponent of this theory was Isadora Duncan who believed that the formal training of classical Ballet stunted normal female development by not allowing freedom of movement of the bust and pelvis. Lenin invited Isadora to teach in Moscow after the revolution to bring a new style of training to Russia. A glance at Isadora teaching her girls in their teens shows how far removed they were from the flat chested anorexics that we have grown accustomed to see on the ballet stage.

Growth and Power

Tanner's research into childhood growth patterns clearly revealed the variation in growth velocity and the differing timing of the peak height velocity for girls and boys. Girls enter their period of peak height velocity just before menarche and are thus more or less fully grown before they can reproduce. Boys peak later. During this period of very rapid growth, the body has a very high nutritional requirement which will obviously be magnified if that growing adolescent is involved in training. This is a time for care, not only with regards to nutrition, but also with regard to changing body proportions and limb lengths producing the gawky teenager whose coordination may not be perfect until he learns to adjust to his new size. Obviously girls in training will also have to face the differences caused by menstruation, possible prementrual tension and training causing irregular periods.

How does the growing body cope with exercise? The cardiac output at submaximal excercise of an 11-13 year old boy is 1-2 litres per minute less than that for a young adult man (Eriksson 1972). The maximal heart rate decreases with age peaking at about 230 beats per minute at 5-10 years of age. (Astrand & Christensen 1964). It should be remembered that the resting heart rate also

decreases with age from the 140 beats per minute of a newborn baby. Maximum oxygen uptake also decreases with age peaking at about 10 years for girls and about 15 years for boys.

"Athletes heart' has been demonstrated in young prepubertal male swimmers (Rowland 1987) with lower resting heart rates and echographic findings consistent with chronic left ventricular volume overload. Faediatricians need to be aware of this condition in order to avoid misdiagnosing disease. The ECG findings are of course normal. The heart is obviously functionally enlarged - do we consider this normal? In a similar vein, preliminary findings have shown that the stress induced blood pressure rises caused by running in very young children 3-4years old are predictive of hypertension in adult life (Sallis et al 1989)

Maximal isometric strength also varies with age (Asmussen) The number of fibres in a muscle group is probably established at 4-5 months of foetal life (MacCallum 1898; Gallinck 1981) although the thickness of the fibres changes from 1-10u in foetal life to 2-20 u at birth and 10-100u in adulthood (Lockhart 1973)

Growth in length of the fibre is acheived by an increase in the number of sarcomeres which are added on to the end of the fibres, individual sarcomeres stay the same length. Growth in area is accomplished by longditudinal splitrting of the myofibrils when they reach a critical size so that there is an increase in the number of myofibrils (Goldspink 1970) Muscle fibre differentiation is at 20 weeks gestation and is probably complete by one year (Colling and Saltin 1980). The baseline ratio between slow type I fibres and fast type II fibres is genetic but habitual use ie training , changes and establishes the final ratio. Thus the fibre type distribution and ultrastructure of skeletal muscle is no different in a 6 year old than in an adult (Bell et al 1980)

NEUROLOGICAL CONSIDERATIONS - As the child's muscular system grows and develops, so the neurological apparatus undergoes maturation and development. Proprioceptive patterns are established so that at first the child can acheive simple tasks such as keeping the trunk upright and steady and later can perform precise complex movements such as the gymast balancing on a bar. Coordination and patterns of movement are laid down. For example, the new born baby will exhibit a wall reflex but as this is lost, it will be nearly a year before the child will learn to walk again. This may seem to be stating the obvious but the concepts are relevant to training for sport. Young children are perhaps easier to train than adults in some agility movements, their bodies are still receptive to learning new patterns of movement. however no amount of training will allow a child to perform a feat that his neurological system is not ready for.

TRAINING IMPLICATIONS

I have briefly mentioned the nutritional needs of the adolescent. When considering training needs and nutrition it is important to remember certain basic facts.

1. A developing child has about twice the calorific needs of the adult - 120 calories per kilo at one year, 80 cals per kilo at 12 years (adult level 40).
2. The protein needs of a normal unathletic 12 year old are double those of an adult (2 gm per kilo per day)
3. The child's body has a greater fluid requirement - 150 mls per kilo at 1 year; 70 mls per kilo per day at 12 years and 50 mls per kilo for an adult.

Thus not only will children need adequate nutrition during training, they will also deplete their body fluids quicker in heat or prolonged exercise. Also getting children to 'sweat off' weight gains for competitions such as Judo for instance can be more dangerous than for an adult player.

PSYCHOLOGICAL ISSUES - Psychological issues in training not only provide motivation for sport, they also provide the major source of training stresses for children and teenagers who can find themselves doing it all for mum or dad or the teacher. Parental overinvestment in their children doing well can result in tremendous pressure. The coach wanting to win too much and forgetting the welfare of his proteges.

Parents can be linked in a symbiosis - an inability to see their child as an individual but only as an extension of their self. Thus the parents are acheiving their own ends through their offspring.

Is competition good for an individual? What happens to the self esteem of a young person who never wins, who trains hard and cannot satisfy his dad?

How many young athletes never reach the adult circuit due to the "BURN OUT" caused by being pushed too hard to early and losing the enjoyment of the game and the meaning of play?

REFERENCES

TANNER J.M."Growth at Adolescence" 1962
ERIKSSON B O "Physical training, oxygen supply and Muscle Metabolism in 11 to 13 year old boys" Acta Physiol Scand 1972
ASTRAND P.O. & CHRISTENSEN E.H. "Aerobic work Capacity" in F Dickens "Oxygen in the animal organism" Pergamon Press 1964
ROWLAND TW; DELANEY BC; SICONOLFI SF "Athletes heart in prepubertal children" Pediatrics 79 5 800-4 1987
SALLIS J.F.et al 'Stability of blood pressure reactivity to exercise in young children" J Dev Behav Paediatr Feb 1989

ASMUSSEN E "Growth in Muscle Strength and Power" in GL Parick "Physical Activity, Human Growth and development" Academic press Inc New York 1973
MACCALLUM J.B."On the histogenesis of striated muscle fibre and the growth of the human sartorius muscle" Bull John Hopkins Hosp 9 208 1898
LOCKHART R.D. "Anatomy of muscles and their relation to movement and posture" in Bourne "The structure and function of muscle" Vol1 Academic press New York 1973
GOLDSPINK "The proliferation of myofibrils during muscle fibre growth" Journal of cellular science 6 593 1970)
COLLING- SALTIN A.S. "Skeletal Muscle development in the human foetus and during childhood" in Berg and Eriksson "Children and exercise IX" University Pres Baltimore. 1980
BELL et al "Muscle fibre types and morphometric analysis of skeletal muscle in 6 year old children" Med Sci Sports Exc 12:28 1980

* * * * *

SPORTS MEDICINE

HEALTH AND EXERCISE, LIASON BETWEEN THE SCHOOL DOCTOR AND THE PE STAFF

Traditionally the Pe staff have been associated with the school doctor in many educational establishments - unfortunately this liason has not always been a happy one - particularly for the school children. The memory from my school days, which I am sure is not unique, was of a rather beefy 'hocky sticks' type of woman who made you undress in a cold room in front of a shrivelled old female doctor who probably trained with Elizabeth Garrett Anderson. The tale told to many an aghast first year was that this old hag wanted to see your breasts and poke you in strange places - you had to be careful what you said to her - if you admitted you had period pains, you were likely to get sent on a cross country run; if you didn't have periods at all then you felt a failure, you were an underdeveloped freak and if you started early that caused whispered conversations which you understood little of.
I clearly remember being asked at 11 years of age if I had periods and being a studious girl from a family where such things were not discussed, I naturally thought that the PE teacher was referring to lessons so I said "Yes, I've had five periods today!"

It is not much easier for the **boys** - being marched by an ex sergeant major who fancies himself leading the cadet force - into a freezing room where some semi retired GP grasps your scrotum and diagnoses undescended testicles - because the poor devils have leapt into the cover of the inguinal canal to escape from the cold and the assault to their dignity. A sad example was a depressed young man of 15 who had opted out of school, had no friends and was isolating himself at home - why? he eventually told me that it was because he was not like other boys - he was unmanly and could never have children - the doctor had told him - he thought he had no balls! - he did not dare to show anyone his body, he would not allow doctors to examine him. I made a bet with him that he was not so different from anyone else and that if he let me look, I promised to get some help for him. When I examined him he was perfectly normal with two descended testicles and normal development - we were able to joke that rather than being impotent - I did not want him keeping me too busy by fathering too many babies in the district!

So, these are the horror stories, those examples of bad practice which we hope are confined to the past. However tales of this nature have coloured the pupils view of the school doctor / Pe staff combination.

Let me start again. Health and exercise, the perfect liason of PE and doctor. Perhaps our modern generation of teenagers are able to collate the two more easily than their parents did? Has a generation brought up on aerobics, good morning Lizzie on TV am and Jane Fonda workouts come to realise the value of exercise? Unfortunately the statistics that are emerging from surveys and information from schools would indicate the opposite. The Youthscan survey by Professor Butler's team found that the majority of teenagers spent their leisure time sitting on their back sides watching television and videos. While doing so they tend to eat junk foods and crisps so poor nutrition and obesity are just around the corner.

How can the doctor and gym teacher work together to promote a

healthier youth? Both have expertise which could be of enormous benefit to the young. School meals have almost gone by the board nowadays - in one school I know the set meal was a sandwich and chips every day of the week! Teenagers on poor diets cannot be expected to excell in physical excercise. Dietary counselling, given in an acceptable way would be very useful. The health message needs to be 'sold' to the young in the right way. So often teenagers can equate healthiness with being told NOT TO - don't smoke, don't drink, don't have sex!

The way in is to go for the positive side. A very disruptive group of teenagers in an intermediate treatment centre responded to advice on body building. I asked them what they would like to talk about. They started with the usual doctor baiting - trying to shock and wanted to talk about a body builder on steroids who had viciously murdered a prostitute. So we talked about that and what steroids do to your body and what you can do to have a strong attractive body without resorting to drugs - within a few weeks they were weighing and measuring each other, testing their eyesight, checking each other's diets and devising exercise programmes to aid strength, suppleness and stamina - if nothing else the fitness of the average South London mugger was certainly improved that term!

The school doctor can therefore cooperate with the PE staff on the aspects of fitness to perform sporting activities. Another important side which is often forgotten, is the doctor's part in advising regarding the type of exercise to be recommended for a pupil. So often children become discouraged by being unable to perform, by feeling they are letting the side down and rather than being able to switch to a sporting activity which they are better suited to, they are forced to continue, become games lesson refusers, are turned off sport for the rest of their lives and sometimes actually truant from school because they cannot stand games and cannot be 'let off' without a medical note.

This is where the doctor should provide a useful note - not the usual - "James should be excused Games for two weeks because of asthma" but "James is an asthmatic boy who will not be able to take part in running activities, particularly in cold weather. He should be able to perform more static exercise indoors and would find swimming or trampoline work beneficial"

Thus exercise can be used in a positive way - what can the child do? not what can't he do. A teenager with short stature may find sprinting more difficult - his legs are shorter, so if he wants to run perhaps he should go for long distance endurance type running. A slow runner will be at a disadvantage in hockey or football field - so let him be the goalkeeper. If a child is a keen swimmer but hates diving don't make them dive in or you will put them off swimmimg too - these are all obvious points but nevertheless important - it does not take a doctor to make such observastions but the school doctors pronouncements carry conviction and by discussing thjese matters with PE staff the children can be saved a lot of misery. However the doctor cannot expect to contribute usefully by remaining inthe ivory tower of the medical room - he or she must walk around the school, watch the activities, see the games lessons in progress. Watch the types of movements.

Growth and development is another important field for discussion. Young gymnasts and ballet pupils are often caught in the trap of having ntheir favourite sport prejudicing their development, delaying their menarche and bringing them to the verge of anorexia.

These problems need to be discussed with parents and staff in an empathetic way.

What of the other side? How can the PE teacher help the doctor. Obviously the PE staff see the children with few or no clothes on at times and this can be a good opportunity to pick out defects and problems which can be reported to the doctor. Bruises and signs of abuse are important of course, but perhaps even more so the child who will not undress - what is that hiding? rather than get into a battle this should be explored by thje doctor.

Scoliosis can be picked up if the PE teacher observes the children touching their toes, incoordination and undue clumsiness in movement may warrant medical advice. Hand eye incoordination in ball games for example may reveal visual defects. Weight loss or gain, obesity or anorexia may also be noted.

Finally a word about two other items which may prove worthwhile to discuss - the psychological side of sport refusal I have mentioned - but also we must not forget the competitive aspects of sport which can be very damaging to the child who does not succeed. Psychological issues in training not only provide motivation for sport, they also provide the major source of training stresses for children and teenagers who can find themselves doing it all for mum or dad or the teacher. Parental overinvestment in their children doing well can result in tremendous pressure. The coach wanting to win too much and forgetting the welfare of his proteges.

Parents can be linked in a symbiosis - an inability to see their child as an individual but only as an extension of their self. Thus the parents are acheiving their own ends through their offspring.

Is competition good for an individual? What happens to the self esteem of a young person who never wins, who trains hard and cannot satisfy his dad?

How many young athletes never reach the adult circuit due to the "BURN OUT" caused by being pushed too hard to early and losing the enjoyment of the game and the meaning of play?

My last point concerns Martial Arts in School. Often these are taught in Girls schools as a self defence. I would emphasise that girls should never be lulled into the false sense of security that they can defend themselves, these activities are sport, exercise but not defence. Occasionally disreputable groups flourish up and sell their kind of Martial art in schools, a recent example was Kateda - this placed great psychological pressure on participants and could be extremely damaging. The school doctor must be aware of these activities being introduced into schools and assess them and advise staff accordingly.

MARATHON TRAINING AND ITALIAN PASTA

Diana Birch

I have two treasures bought at the 'Little Italy' annual fair in Clerkenwell - my car sticker "Mafia staff car - keepa the hands off" and my Tee shirt sporting the slogan "Pasta Power" which I wear for Judo fights. Many a true word is spoken in jest, as they say. Nowadays the 'Spaghetti house' chain hosts a special pasta binge (Spaghettata) the evening before the London Marathon!

'Why?', you might ask - As an Italian I would be tempted to reply 'why not?' but there are indeed scientific reasons why a British marathon cannot be won on fish and chips! Carbohydrates provide over 10% higher energy yield than dietary fat and are the preferred endurance training energy store - except for in migrating birds and salmon where weight is at a premium - however we are not racing carrier pidgeons!

During exercise muscle energy can be supplied by ATP breakdown or glycogenolysis. In high energy short duration exercise (under one minute) power bursts are produced by ATP whereas in longer duration exercise (over ten minutes) the energy source is mainly glycogenolysis. The mid-range provides a shifing spectrum between the two extremes.

The Marathon is the endurance exercise par excellence. A marathon runner burns off 15 kcals per minute or 2,800 kcals during the race, equivalent to 500gms of carbohydrate. In contrast the energy demand at maximal exercise for a sprinter exceeds 50 kcals per minute. All the available ATP will maintain this energy demand for one second and phosphocreatine by regenerating ATP will yield another few seconds, thus maximal effort cannot be maintained for the ten seconds of the 100 metres dash. The last seconds are fueled by anaerobic glycogen breakdown generating lactate and thus limiting the length of exercise time.

The last thing that a marathon runner wants is a lactate build up. Hence speed is avoided in the early stages of the race. A slow build up of pace allows <u>aerobic</u> glycogenolysis to switch into gear thus providing a steady long term energy burn.

So far so good - runners will be going well until perhaps 18 - 20 miles when they 'hit the wall' - energy levels fall - they cannot go on. This 'wall' corresponds to depletion of muscle glycogen. Measures such as correct hydration, sips of water and perhaps fructose drinks during the race help to stave off the 'wall'; glucose supplements before racing tend to produce an insulin response and thus lower available blood sugar; pre excercise meals help; but the most effective measure is to ensure maximal muscle glycogen storage before the race by carbohydrate loading.

Dietary enhancement of marathon performance was recorded in Greece as early as the fifth century BC but the first attempts at carbohydrate loading were in 1939 by Christensen. He developed a two phase regime for the week before the race. In the first three days (depletion phase) a low carbohydrate, high fat and protein diet was taken and the athlete exercised to deplete muscle glycogen. Thus glycogen synthetase was stimulated. The second phase was four days of high carbohydrate loading ending with a meal four hours prior to the event. These athletes on a high carbohydrate diet could exercise for three times the duration of athletes with a high fat diet as their energy source.

The disadvantage was that the depletion phase produced irritable unhappy athletes who could not train. Sherman modified this in 1981 by doing away with the depletion phase and substituting a rest period - this seems to work as well and forms the basis of Marathon diets today. So whether it be Spaghetti, fusilli, penne, linguini or lasagne - happy running and "Buon Appetito!"