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Author(s)	Michael Chia & Steven Tan
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# RESISTANCE TRAINING IN PRIMARY SCHOOL: A CAUSE FOR CONCERN?

Review by Michael Chia and Steven Tan



## INTRODUCTION

Information about the health risks associated with being over-fat and overweight even at the primary school level is pervasive. Since the inception of the Trim and Fit (TAF) programme in 1992, many primary schools have taken ownership of the problem of 'creeping obesity' among young people by being proactive in their efforts to encourage young people to be more physically active in their daily lives. Some of these efforts have involved the introduction of resistance training programmes to young

people. Some of these programmes encompass the use of specialised weight training machines such as the multi-stations and also aerobic-type machines like motorised treadmills and cycle ergometers. According to unpublished figures offered by the Physical Education Unit of the Ministry of Education, up to 80% of primary schools in Singapore have some sort of weight training equipment.

Whilst the use of innovative programming such as making available weight training

facilities to young people is laudable, there are concerns among physical educationists and parents about the safety and appropriateness of weight training for primary school pupils. It is important and necessary that teachers who conduct such weight training programmes be discerning as to what weight training practices are appropriate and safe for the paediatric population. The situation is made more difficult as many physical education teachers are more familiar with the adult weight training principles, with little or insufficient knowledge of the appropriateness and applicability of such training principles to the paediatric population. The problem is exacerbated by weight training textbooks and journals targeted for adult consumption or by body-building literature that propagates information that may be inappropriate or harmful when applied indiscriminately to young people.

This paper highlights and puts into perspective some of the scientific evidence regarding the value of resistance training in young people. It also addresses some developmental concerns for young people and provides guidelines for structuring resistance training programmes in primary schools.

### **The importance of muscular strength and endurance**

The development of muscular strength and muscular endurance are common outcomes of resistance training. Muscular strength is the ability of a muscle or a group of muscles to generate maximum force at a particular speed over a specific range of motion. Muscular endurance is the ability of a muscle or a group of muscles to generate force at a particular

speed and over a specific range of motion over a sustained period of time. Resistance training which usually takes the form of weight training is the use of free weights, weight training machines or even body weight to bring about improvements in strength and muscular endurance.

Muscular strength and muscular endurance are important fitness attributes to primary school pupils as they are necessary in daily activities such as running up a flight of stairs or carrying a bag pack filled with schoolbooks. Strength and muscular endurance are also essential ingredients for success in various sports activities and are among the key fitness components assessed in annual school fitness tests, albeit the relative importance of the two variables may vary, depending on the demands of the sport or the specific fitness test.

## **REVIEW OF LITERATURE**

### **Strength gains during <sup>1</sup>preadolescence with training**

Previous research on boys contributed to the view that resistance training during the pre-pubertal years *was ineffective* and had not resulted in gains in strength (Ainsworth, 1970; Virjens, 1978). It had been suggested that strength gains were not possible with training until circulating testosterone levels (a hormone with muscle-building effects) increased substantially during mid- to late puberty (Blimkie & Bar-Or, 1996).

However, in studies that have involved moderate to high training loads and have controlled for the effects of growth and motor skill acquisition, significant and substantial strength gains during pre-

<sup>1</sup> Preadolescence is defined as the period prior to sexual maturity

adolescence have been documented (Blimkie, 1992; Ozmun, Mikesky, & Surburg, 1994). In concordance with adult studies, the magnitude of strength gains in this group of young people with training is dependent on the interplay of the volume (amount) of training, the training intensity (how strenuous) and to a lesser extent, on the duration of the training.

In a controversial 20-week study, Ramsay, Blimkie, Smith, Garner, MacDougall & Sale (1990), trained a group of normo-active, healthy pre-pubertal boys (aged 9-11 years) using resistance training at 75-85% of 1RM of elbow flexion and leg extensions. At the close of the training, improvements of between 21-37% were documented in a series of 1RM performances over the pre-training values. Evidently, the cited study represents cogent evidence that strength gains following specific training in young boys are possible.

The optimal combination of mode (type) of training, the training volume, intensity and duration for maximum strength gains in pre-adolescent young people have yet to be determined and remains a fertile area for research attention. The majority of research studies have involved only boys, with a paucity of studies on girls. The issue of whether girls demonstrate similar patterns of strength development as boys with training therefore needs to be addressed in future research.

### **Persistence of strength gains following training**

There has been limited research in this area since strength loss following structured training may be off-set by concomitant strength gains due to the normal processes

of growth and maturation (Blimkie & Bar-Or, 1996). In a single study on pre-adolescent boys, a single, once-a-week high intensity training session was insufficient to preserve prior-training-induced strength gains (Blimkie, Martin, Ramsay, Sale & MacDougall, 1989). On the basis of the limited research, it appears that training-induced strength gains are impermanent and that a single high intensity training bout per week is insufficient to maintain training-induced strength gains. No firm guidelines can be drawn about the requirements for maintenance of strength during pre-adolescence implying that further research into this area is also needed.

### **Developmental considerations for young people**

It appears that there is an increased popularity in the use of dynamic resistance training to develop strength and muscular endurance in school children today. It is therefore prudent to pay attention to a number of developmental considerations for young people, so as to harness the optimal benefits that can be derived from such training efforts. These considerations are that:

- as children are still growing, and there is a need to prevent the occurrence of growing plate injuries that would result in stunted growth (Micheli, 1996);
- young people have shorter attention spans than adults and are less likely to adhere to exercise for long periods of time;
- children should have exercise opportunities which provide enjoyment and sustain their interest;

- young children need to feel successful and it is more important to stress personal improvement rather than inter-individual competition;
- during pre-adolescent, children have to experience a wide variety of physical and sporting activities rather than just focusing on resistance training as a predominant activity;
- children are not miniature adults, so it is necessary to select weight training machines and equipment that have been customised for them rather than those designed for adults;
- as children have higher potential for injury during resistance training, it is imperative that they should be supervised and monitored closely by appropriately trained personnel.

## CONCLUSION

Research suggests that young people can benefit from a structured and properly supervised resistance-training programme, although the majority of the data are on boys. The benefits of resistance training to the general health and well being of young people are numerous. For example, one can expect increased muscular strength and endurance, enhanced enjoyment and improvement in sports performance, improved self-concept of young people, proactive prevention of osteoporosis in the advanced adult years (particularly for females) and possibly positive attitudes carried over into adulthood about resistance training as a life-long physical activity. Physical education teachers play a pivotal role in sowing the seeds, nurturing them and allowing their pupils to harvest some of the fruits of their resistance training efforts.

## IMPLICATIONS

Attention to the following guidelines will help ensure the safety and enjoyment of young people during strength training in a non-competitive sports or physical education programme.

- 1. Determine exercise intensity by assessing 10-12 RM (if strength and muscular endurance are the training goals) or 15-20 RM (if muscular endurance is the training goal).***

The use of one-repetition maximum (1RM) effort (i.e. the maximum amount of weight that a pupil can lift or move in a single action) in strength testing in preadolescent young people is contentious. Prudence indicates that children must not attempt to perform 1 RM effort to avoid acute injuries to the growth cartilage and plates located at each end of the bone.

**2. Exercise at between 50% to 80% of the respective RMs in a progressive manner (Blimkie and Bar-Or, 1996).**

Start exercising at the lower workload (e.g., 50% of 10-RM) and progressively increase to higher workload levels. The training programme should not focus on lifting maximal or near maximal loads (e.g., > 80%) since heavy weights can be potentially dangerous and damaging to the developing skeletal and joint structures. It is also not recommended that resistance exercise is performed to the point of severe muscular fatigue or isolated eccentric-type exercise (e.g., lowering a weight that is too heavy as in a biceps curl exercise) be used.

**3. Perform 1 to 2 sets of 8 to 10 different exercises involving body weights, machines, and free weights.**

The 8 to 10 different exercises selected must ensure that all of the major muscle groups are included for a balanced development. For example, working the muscles of the front of the thigh and the muscles of the back of the thighs. Furthermore, emphasise full-range, multi-joint exercise (e.g., leg press, push-ups) as opposed to single-joint exercises (e.g., leg extension, triceps extension). To promote continual participation and enjoyment of exercise, incorporate variety into the resistance training programme and allow young people to exercise to their favourite music.

**4. Teach proper techniques for all exercise movements first, followed by gradual application of resistance or weights.**

Educate pupils on the importance of learning proper techniques and developing an interest in resistance training. Stress that exercise should be performed through their natural range of motion and in a manner in which speed is controlled, i.e., avoid fast and jerky movements in order to achieve optimal improvement. Avoid comparing with other individuals as to who can lift the heaviest or the most number of repetitions.

**5. Alternate days of training with rest days.**

Train no more than two to three times a week. Children can experience a higher incidence of overuse injuries if exercise is excessive or if the child experiences acute trauma. Encourage young people to participate in other forms of physical activities involving all major large muscle groups to optimise aerobic fitness and weight management.

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