

# Physical activity—key issues in treatment of childhood obesity

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## INTRODUCTION

Childhood obesity has become one of the major diseases of this century. The increasing number of obese children in outpatient clinics emphasizes the necessity of developing effective treatment programs. Management of childhood obesity is commonly based on lifestyle interventions where nutrition, physical activity and behaviour modification are the main targets (1). There is a substantial body of research and broad clinical practice on nutritional aspects, but little has been written about practical physical activity recommendations in the treatment setting. In this paper we will briefly review the latest news regarding physical activity in the treatment of paediatric obesity focusing on practical treatment programs. Secondly, we will cover key issues that healthcare providers can discuss with obese children and adolescents and their families as a tool for a professional conversation.

## DEFINITIONS

*Physical activity* is a comprehensive concept and includes any body movement achieved by contraction of skeletal muscles that increases energy expenditure above resting levels (2). *Exercise* is a subcategory of physical activity and is defined as voluntary, planned, structured and repetitive physical activity performed because of anticipated positive consequences on physical, psychological and/or social well being. Exercise improves and maintains physical fitness, which is a set of attributes related to the ability to perform physical activity that people have or achieve. *Physical fitness* encompasses cardiorespiratory fitness, strength, coordination, flexibility, etc. *Cardiorespiratory fitness* relates to the ability of the circulatory and respiratory systems to supply oxygen during sustained physical activity. MET (metabolic equivalent) is a unit used to estimate the metabolic cost (oxygen consumption) of physical activity. One MET equals the resting metabolic rate of approximately 3.5 mL O<sub>2</sub>/kg and min. *Light activity* is defined as activity corresponding to an energy expenditure below 3 METS, such as walking slowly (<3.5 km/h). *Moderate physical activity* is defined as activ-

## Abstract

Changes in physical activity with the aim of increasing energy expenditure are usually an important component of childhood obesity treatment. Physical activity also has several other aspects that are positive for the obese child's health, such as improving the metabolic profile and psychological well being. The aim of this paper is to give a short review of what we know about physical activity in paediatric obesity treatment. In addition, practical recommendations will be presented which a health care provider can suggest to obese children and their families with a special focus on daily activity, participation in physical education classes and sports, sedentary behaviours, active commuting to school and how to get family and friends involved in supporting the child.

ity that requires three to six times as much energy as the energy needed in a resting state, such as climbing stairs. *Vigorous physical activity* requires more than six METs, such as jogging 8.0 km/h. *Physical inactivity* equals low levels of physical activity and may be defined as a state where energy expenditure approaches resting energy expenditure (3).

## ROLE OF PHYSICAL ACTIVITY AND RECOMMENDATIONS

The main reason why physical activity is a key component of childhood obesity prevention and treatment is its major impact on body composition and metabolism (4–6). Physical activity increases energy expenditure, which contributes to weight loss. Furthermore, it increases and maintains lean body mass, which increases the capacity for mobilizing and burning body fat while using the muscles and in a resting state (3).

Regular physical activity also has many other desirable outcomes for the child's health (3,7). Physical activity is necessary for normal growth and development of cardiorespiratory endurance, muscle strength, flexibility, motor skills and agility. In addition, physical activity, particularly weight-bearing activity (any activity done standing up, such as walking, jumping or weight lifting) is important for bone development (8,9). There is also evidence of an association between physical fitness and cardiovascular risk factors such as blood lipids and fasting glycaemia in children and adolescents (10,11). Regular aerobic physical activity leads to a significant cardiovascular risk reduction by improving lipid profile, especially in children and adolescents who exhibit unfavourable baseline lipid and lipoprotein concentrations (12). Furthermore, regular physical activity is associated with well being and seems to promote self-esteem in children and adolescents (13).

The impact of physical activity on obesity has been investigated with conflicting results (14). Changes in energy expenditure or energy intake can occur at critical periods of development (e.g. in early infancy or adolescence) and may result in energy imbalance (15). There can also be individual differences and susceptibility to the impact of increased

energy expenditure on the regulation of energy balance. Thus, the role of energy expenditure in obesity can differ among population subgroups, such as male versus female, active versus inactive and different ethnic groups. Furthermore, it can have differential impact in individuals at different stages of development. It is possible that susceptible individuals fail to compensate for periodic fluctuations in energy expenditure.

Physical activity of children and adolescents varies with age, type of exercise and setting. How much physical activity is needed to improve or maintain health? According to the recommendation of World Health Organization much of the health gain is obtained from a minimum of 30 min of cumulative moderate physical activity daily (16). For children and young people WHO recommends an additional 20 min of vigorous physical activity three times a week. Recent guidelines from other organizations have increased this recommendation to one hour per day (17,18). Nordic Nutrition Recommendations state that this recommended hour of activity should include both moderate and vigorous intensity and can probably be divided into shorter intervals of physical activity during the course of the day (18).

Strong and colleagues recently proposed similar recommendations after a systematic review of the evidence base for health and physical activity in school-age children (17). They also recommended 60 min or more of physical activity, which can be achieved in a cumulative manner in school during physical education class, as well as before and after school programs. For youth who have been physically inactive, an incremental approach to the 60-min goal is of particular concern.

However, one hour of physical activity might not be enough to prevent clustering of cardiovascular disease risk factors. The European Youth Heart Study recently presented this conclusion in the *Lancet* (19). The main findings of this study of 1732 randomly selected 9- and 15-year-old school children from Denmark, Estonia and Portugal included a graded negative association between clustering of risk factors and physical activity. There was an increased risk in the first to third quintile of physical activity compared with the most active quintile. Time spent at moderate and vigorous intensity activity (corresponding to a walking speed of around 4 km/h) in the fourth quintile was 116 min in 9 year olds and 88 min in 15 year olds. Thus the authors stated that physical activity levels should be higher than the current guidelines. Obtaining 90 min of daily activity might be necessary for children to prevent insulin resistance, which seems to be the central feature for clustering of cardiovascular disease risk factors. How can we forward this message to children and adolescents who in our modern society are becoming more and more inactive?

### SEDENTARY BEHAVIOURS

Sedentary behaviours, particular watching television (TV) and videos, have been found to be related to a higher BMI in children and adolescents (20–23). Furthermore, insulin resistance as a first step toward glucose intolerance could develop. Insulin resistance and other metabolic complica-

tions are frequently detected even in young children (24). To reduce childhood overweight, successful interventions have focused on limiting time spent in front of the television (25,26). The likely mechanism for the effect of TV viewing is its impact on energy balance through decreased energy expenditure (less time being physically active), reduction in resting metabolic rate (27) and increased energy intake (overeating while watching TV and exposure to commercials promoting unhealthy foods) (28,29). Furthermore, television viewing in childhood and adolescence has been associated with overweight, poor fitness, smoking and raised cholesterol in adulthood (30). TV has also an undesirable impact on the behaviour of small children (23,29). A recent study has shown that having a TV in the bedroom is a risk factor for childhood overweight, independent of reported physical activity, TV or movie watching time and internet use at home (31). In this study, frequency of internet use by children was not significantly associated with overweight status.

However, the literature linking physical inactivity with risk of overweight and obesity is not consistent (32,33). The available evidence indicates that sedentary behaviours are not the mirror image of physical activity and that the two types of behaviours are relatively uncorrelated (34). Furthermore it might be a difference between time spent watching TV or playing computer games due to the difference of the effect on the metabolism, as mentioned above (35,36). It has been suggested that video game play results in significant increases in various metabolic and physiologic variables and the increase in metabolic rate might be similar in magnitude to mild-intensity exercise (37). It has also been indicated that physical activity is not inversely associated with watching TV or playing video games, but positively associated with productive sedentary behaviour and part-time work. Some students appear capable of managing their time better than others. As such, reducing TV viewing may not be enough with respect to increasing physical activity. Time management skills may be necessary to encourage participation in physical activity (38).

Gender, age, ethnicity and BMI are related to sedentary-behaviour time to varying degrees. It has been shown that girls report more time spent listening to music and talking on the phone, whereas boys are involved in more time playing computer games (32). As children move into their teenage years, they likely increase the time that they spend engaging in multiple sedentary behaviours that compete with spontaneous activities. Older adolescents have more time that is not supervised by a parent, which creates opportunities to increase TV viewing time and other sedentary behaviours.

### PHYSICAL ACTIVITY IN CHILDHOOD OBESITY TREATMENT—10 PRACTICAL RECOMMENDATIONS

The 10 recommendations below are used in treatment in a tertiary referral centre for obese children and adolescents in southern Sweden. These recommendations are derived from available research and developed in clinical practice with almost one thousand obese children and adolescents and their families over the past few years. Our treatment is based

**Table 1** Valuable questions to ask the obese child about physical activity

- (1) How do you get to school?
- (2) How many times a week do you have physical education class?
- (3) Are you active at all times during your physical education class?
- (4) What do you usually do after school?
- (5) What do you usually do during the summer?
- (6) When you meet your friends, what do you usually do?
- (7) How many hours do you usually watch TV on weekdays/weekends?
- (8) How many hours do you usually spend in front of the computer on weekdays/weekends?
- (9) Do you participate in sports? How often?
- (10) If not, have you thought about taking up a sport?
- (11) Are you active in any sports club?
- (12) If you sum up all your activities that you have during a day, like walking your to school, walking during the school breaks, PE class, and hobbies during spare time, are you active at least one hour a day?
- (13) How many minutes a day are you out of breath; for example, when your heart beats a little faster because you are walking fast or climbing stairs?

on family therapy given by a multidisciplinary team (39–41). During family therapy sessions, lifestyle modifications are encouraged and increasing physical activity is one of the main components (42). In Table 1, we also give suggestions for questions valuable to ask an obese child when assessing the child's physical activity. These questions are part of a structured program at our treatment centre.

### Reduce sedentary activities

Epstein and colleagues demonstrated that reinforcing a decrease in sedentary behaviour resulted in greater weight loss than reinforcing an increase in physical activity or reinforcing both behaviours, for example, encouraging children to spend less time playing computer games is more effective than encouraging them to participate in sports (43). However, in a later study (26) increasing physical activity compared to decreasing sedentary behaviour showed no significant difference. Thus, talking to parents about their children decreasing sedentary behaviours might be equally effective as discussing increasing physical activity.

Sedentary children should progress toward the recommended level of physical activity gradually. One way of decreasing sedentary behaviour is limiting media time (with entertainment media) to no more than 1–2 h of quality programming per day for older children, as recommended by American Academy of Pediatrics (44).

### Encourage spontaneous play

Spontaneous play has several beneficial effects on child development, not only by improving physical fitness, as all tissues and organs require activity for optimal development. Play can also improve self-esteem; children develop movement skills and feel more secure about what they can accomplish with their body, which improves their self-esteem. Furthermore, children learn social skills when they cooperate with others during play. Playing may also enhance the child's cognitive skills by exploring the environment and acquiring new experiences and lessons in how to solve problems.

**Table 2** Examples of how everyday activities can be accumulated during a common day

Example 1. How can a child accumulate 1 h of everyday activities

Walks to school	10 min
Plays during breaks	20 min
Walks home from school	10 min
Cleans room	10 min
Walks to meet friends	10 min

Total 60 min

Example 2. How can a child accumulate 1 h of everyday activities

Rides bike to school	5 min
Walks and talks during breaks	20 min
Rides bike home from school	5 min
Goes shopping	10 min
Walks the dog	20 min

Total 60 min

**Table 3** Examples of how everyday activities can decrease during a day

Example 1. How can a child lose 1 h of everyday activities

Mother drives to school	–10 min
Sits during breaks	–20 min
Rides bus home from school	–10 min
Watches TV	–10 min
Father walks the dog	–10 min

Total –60 min

Example 2. How can a child lose 1 h of everyday activities

Rides bus to school	–10 min
Sits during breaks	–20 min
Rides bus home from school	–10 min
Mother cleans room	–5 min
Plays computer games	–15 min

Total –60 min

### Discover daily activities

Studies have shown that children who walk to school are more active than those who do not (45,46). Several reasons are thought to account for low levels of walking to school. Walkable neighbourhoods with destinations near homes, interconnected streets and high residential density are associated with more walking and cycling for transportation. Parental safety concerns such as travel distance, traffic and crime have been linked to inactive commuting. A recent study showed that when parents had few concerns, children were five times as likely to actively commute to school as when parents had many concerns (47). Incorporating physical activity into a daily routine (e.g., through active commuting) may produce long-term maintenance of the activity and provide the basis for an active adult life style.

Even mild forms of physical activity such as washing dishes, shopping, cleaning, or walking to and from the bus increase energy expenditure compared with very sedentary activities such as watching TV. These everyday activities can play an important role in the child's life. One hour of everyday activities can easily be accumulated, see Table 2.

This hour of everyday activities can also easily disappear, see Table 3.

### Discuss physical education class

Almost 10% of children in Sweden are not at all active (48). Physical education class might be the only opportunity for many children to participate in vigorous activities. In addition, the physical education teacher is an important role model. Schools can offer many opportunities for children to engage in regular activity (17). Health professionals need to encourage children to participate fully in any physical education classes and in any other physical activities offered after school. It is worth discussing alternative solutions if the child cannot be active during physical education class together with other children.

### Increase variety of activities

The recent Nordic Nutrition Recommendations emphasize that physical activity should be as diverse as possible in order to provide optimal opportunities for developing physical fitness, including cardiorespiratory fitness, muscle strength, flexibility, speed, mobility, reaction time and coordination (18). Thus, it is important to combine both aerobic and anaerobic exercise together with daily activities.

Resistance training is gaining popularity among adolescents and many of our obese patients are very interested in this form of physical activity. Resistance training, also known as strength or weight-training, is well established as a method for improving musculoskeletal fitness (49). Several agencies have published resistance-training guidelines for children (49,50). The American Academy of Pediatrics separates the terms *resistance* and *strength training* from the terms *weightlifting*, *power lifting* and *bodybuilding*, and supports properly supervised resistance training programs as a safe method of strength development in children and adolescents (50,51). Parents, teachers, coaches and healthcare providers should realize that youth strength training is a specialized method of conditioning that can offer considerable benefits, but at the same time can result in serious injury if established guidelines are not followed (52). A number of case reports have raised concerns about epiphyseal injuries in the wrist and apophyseal injuries in the spine from weight lifting in skeletally immature individuals. Such injuries are believed to be largely preventable by avoiding improper lifting techniques, maximal lifts and improperly supervised lifts. Thus, preadolescents and adolescents should avoid competitive weightlifting, power lifting, bodybuilding and maximal lifts until they reach physical and skeletal maturity (50). With qualified instruction, competent supervision and an appropriate progression of volume and intensity of training, obese children and adolescents can not only learn advanced strength training exercises, but can feel good about their performance, and have fun (52,53).

### Promote sports

Research has indicated that regular activities of a vigorous character are of importance for children and adolescents. Insufficient vigorous physical activity has been associated as an independent risk factor for higher BMI for adolescent boys and girls (54). In addition, high intensity physical activity has been shown to have a favourable effect on several

components of insulin resistance in obese adolescents (12). Further, emotional well being has also been positively associated with extent of participation in sport and vigorous recreational activity among adolescents (13). Finally, a recent systematic review of the efficacy of prescribed exercise for treating overweight children and adolescents concluded that an aerobic exercise at moderate-to-high intensity is effective for reducing body fat (5).

Encouraging participation in sports is one way of increasing the amount of time spent in vigorous activities for an obese child. It is valuable for healthcare providers to cooperate with sports associations. We have developed a sports camp for obese children with a follow-up support system in local sports clubs. During a one-week sports camp children try at least two activities every day. At the end of camp the children choose their favourite sport. A selected coach from a sports club, close to the child's home, is responsible for introducing the child to a local sports club and supporting him/her during six months in this club. This intervention has been shown successful in improving BMI, body composition and physical activity in a sample of severely obese children compared with the control group (55,56).

### Encourage hobbies

Ideally all hobbies should be active and energy consuming. Any hobby is helpful if it diverts children's attention from eating and from watching television. Hobbies usually lead to better self-confidence through achievement, constructive activity and succeeding with something others cannot do (57).

### Be flexible and patient

The level of physical activity declines with age (58,59). The greatest decline takes place between the ages of seven and ten (60). In particular, activities at vigorous intensities decrease during adolescence. Boys are more active than girls. Girls are less involved in vigorous activities at all ages (61). Thus, it is not unusual for children, especially for teenagers, to change their interest in a particular sport or activity, which usually worries both parents and healthcare providers. Getting adolescents to engage in regular physical activity is becoming even more challenging, with decreased physical education time in schools, insufficient safe areas for after-school outdoor recreation, and competition with indoor, sedentary behaviours such as television viewing, computer and video games (62). It might help to ask the adolescent what sports and activities his/her friends are involved in. In terms of increasing physical activity, social support from family members, and even more from friends in later adolescence, is critical for the child, as described later.

For sedentary and severely obese adolescents easy aerobic activities should be recommended, especially non-weight bearing activities such as swimming, cycling, strength or aerobic circuit training and interval walking (walking with frequent rests as necessary). You can advise the adolescent to gradually work up to longer walking periods and few rest stops (63).

### Involve family and friends

Parents and siblings influence the child in many ways through modelling, social support, as well as with regard to practical aspects like helping with transportation to sports activities. Parental support for physical activity has been identified as a key correlate of children's physical activity behaviour (64). Children and their families should be encouraged to plan regular periods of exercise and engage in shared family activities. For example, parents and children can explore their communities for any biking and walking trails, inline skating, and other recreation areas for fun physical activity alternatives. Using the family to structure and support activity programs is important for long-term change, as parent activity level is a strong predictor of child activity (65,66). Furthermore, inclusion of parents in the treatment has been shown to improve overall long-term outcome of paediatric obesity treatment (39,67).

### Set realistic goals

Although most individuals participate in physical activity because they enjoy the effort, children need physical activity to be fun for them to continue. Adults are more able to participate in challenging activities in order to reach goals related to performance or aesthetics (63). In addition, structured activity programs might be questioned for how they prepare young people for physical activity in adulthood, which is typically unstructured. Programs aimed at promoting activity across the lifespan should focus on the development of activities and skills that promote generalization and maintenance of physical activity during childhood and adolescence and increase the probability of carryover to adulthood (7).

### CONCLUSIONS

In order to help the obese child or adolescent in weight management it is not necessary to prescribe structured exercise programs. During a family session the healthcare provider can discuss a range of practical key issues that may result in a more active lifestyle, such as reducing sedentary behaviour, encouraging spontaneous play, promoting everyday activities and sports, emphasizing the importance of physical education class, increasing the variety of activities and encouraging hobbies. Furthermore, it is essential to involve family and friends and to formulate realistic goals for long-term success.

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