

REVIEW ARTICLE

Physical Activities as Key Element in Prevention and Therapy of Overweight Children

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SUMMARY

Introduction: Childhood obesity is increasing, even in Germany. Physical activity in childhood is the key to this problem. Parents are role models for their children. In addition to a genetic predisposition for obesity, there is a strong family influence on the nutritional, physical and social behavior of a child. **Methods:** Selective literature review. **Results:** Present studies of the relationship between physical activity and overweight are often inconsistent due to an assortment of methods and parameters which cannot be compared. Even the function of school sports is not meticulously evaluated. Physical activity recommendations for children are derived from those given to adults. Epidemiological and prospective studies are missing. **Discussion:** Obese children have long histories of athletic failures, overstrain and lack of experience with body movements and success. Sports activities for obese children must be adapted to their specific needs. The early relationship between physical activity and cognitive development has been proven. Therefore we have to compensate for social and family deficiencies as early as possible e.g. in the kindergarten.

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Key words: obesity in childhood, physical activity, characteristics of childhood obesity, social background

The World Health Organization (WHO) has described obesity as a global problem and a worrisome epidemic (e1). In Germany, too, overweight and obesity among children and adolescents are increasing in both prevalence and severity. According to different estimates, 9% to 17% of children in Germany are overweight, and 3% to 9% are obese (e2).

This article is based on a systematic review of literature in the Medline database, which we searched for the expression "physical activity and obesity in childhood." The earlier reviews of Ebbeling et al. (e32), Lobstein et al. (3) and Daniels et al. (9) were also taken into consideration, as was the metaanalysis of Marshall et al. (13).

Obesity is a chronic illness that impairs quality of life and increases morbidity and mortality. Therefore, long-term strategies are needed for its prevention and treatment (e1).

Overweight and obesity are diagnosed in children when the body mass index (BMI) exceeds the 90th or 97th percentile, respectively, for children of the same age and sex in a German reference group (1). Thus, a five-year-old girl is overweight if her BMI is above 17.8 and obese if it is above 19.2. The corresponding values for five-year-old boys are 17.6 and 19.0.

The effects of obesity

The causes of obesity include genetic factors, socialization, significantly reduced physical activity, poorly controlled and unhealthful diet, inadequate time for parenting, and the absence of family structures.

Even in childhood and adolescence, obesity can have many clinically relevant effects, including cardiovascular diseases, metabolic disorders such as type 2 diabetes, orthopedic disorders, and mental illness (2, e3, 3). Clinical effects such as hypertension or abnormal lipid metabolism may remain latent for long periods of time without causing symptoms. Furthermore, because older children and young adolescents often do not visit a pediatrician

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regularly, the clinical consequences of obesity may not be noted till late in its course. [The concepts "U9" and "J1" are unknown to American clinicians, so I have omitted these terms.] Thus, the major adverse effect of childhood obesity, as perceived by the children themselves, is the associated emotional suffering, rather than the physical illnesses to which obese children are prone. Overweight children are stigmatized and ostracized, suffer from low self-esteem, and may react by withdrawing from the society of their peers. The study of Schwimmer et al., for example, revealed that overweight children suffer emotionally to a degree comparable to children with cancer (4).

The importance of exercise in adulthood

The importance of physical activity in adulthood for the prevention of disease, and for rehabilitation, is well documented (5). Despite this, 45% of adults in Germany participate in no sporting activities whatsoever, 30% are barely active, and only 15% exercise enough to achieve a protective effect (e4). In the USA, the largest fraction of health care costs is accounted for by disorders of lipid metabolism, followed by illnesses arising from a lack of exercise (5).

The term "physical activity" refers to any activity that increases the body's energy consumption. It has been conclusively shown that the additional consumption of 2 000 to 3 000 kilocalories per week by muscular work reduces the risk of cardiovascular illness, brings about positive emotional effects, and increases satisfaction with one's own health (e5, e6, e7). The maximal preventive effect from physical activity is attained when the individual is physically active for 30 or more minutes per day, or, alternatively, when the individual trains for three or four 45-minute periods per week involving intense physical activity exceeding 6 MET. (MET is a measure of energy consumption: 1 MET corresponds to the consumption of 3.5 ml of oxygen per kg of body weight.) The most important aspect of physical activity is the improvement of endurance; accompanying exercises should be performed to improve coordination and strength (5).

Evidence-based data on exercise in childhood

Exercise and play are the basis for the development of sensorimotor skills and for healthy intellectual, social and personal development in childhood. Exercise is necessary for optimal cognitive development (e8). Physical stimulation in the first few years of life influences the development of the nervous system and the maturation of the brain. During the school years, excessive emphasis on scholastic achievement with a relative neglect of physical activity is clearly undesirable, for studies have shown that intellectual and physical performance are closely correlated. Good and poor students differ not only in their grades, but also in their motor coordination (e9).

A negative trend in both the general physical condition and the motor coordination of children and adolescents has not just been observed by physical-education teachers, but has also been reflected in declining performance in German nationwide sporting competitions for youth (Bundesjugendspiele) (e9). Hebebrand and Bös, in their review of 54 different studies, conclude that children's motor skills have deteriorated by 10% in the past 25 years. An evaluation of diaries of physical activity shows that the average child in primary school today spends the 24-hour day as follows: lying, nine hours; sitting, nine hours; standing, five hours; exercising, only one hour (e10).

There is no difficulty in concluding that a "sedentary lifestyle" is a risk factor for obesity, as inactivity is relatively easy to measure. Physical activity, on the other hand, is a complex, multidimensional behavior that is hard to quantify (e11). The methodological difficulty of assessing physical activity is greatest for children under 10, whose daily life contains a great deal of spontaneous, unstructured behavior. Small children cannot keep a precise and reliable record of their everyday activities or relate how much time they spent on each. Data obtained from questionnaires on physical activity in this age group are, therefore, very difficult to evaluate. Unsurprisingly, then, only a small number of studies have addressed the relationship between physical activity and body fat in this age group (6). Currently, studies of children increasingly rely on objective methods of measuring physical activity, such as accelerometry, with which periods of relative activity and inactivity can be documented. Measurement systems have also been developed that can register different levels of physical activity. Methods such as these enable a direct comparison between

populations, which would not be possible with questionnaires alone.

Accelerometric studies have documented sex and age differences in children's physical activity and have revealed a marked decline in the amount of moderate physical activity from the prepubertal stage to adolescence (e12). In general, girls spend significantly less time in moderately intense physical activity than boys from an early age onward, and this difference increases with age (e12, e13, e14).

Because little data is available on trends in the physical activity of children over the decades, the international literature takes the low number of children who walk longer distances or ride a bicycle as an indication of a declining level of activity (7). In the United Kingdom, the National Travel Survey of 2001 revealed that the average distance that children travel by bicycle has fallen. Most importantly, the percentage of children who walk or ride a bicycle to school has declined (e15). In a study of ten-year-old children, walking rather than being driven to school was the decisive factor (adjusted for the estimated overall activity at school) contributing to higher levels of physical activity for boys, though not for girls (e16). Walking to school is only a small part of a child's potential physical activity over the course of the day, but it seems that children who walk to school are also more active during the rest of the day. A study of five-year-olds, in contrast, revealed no difference in overall levels of physical activity between children who walked to school and those who did not (8), which suggests that this effect is operative only in older children. Larger prospective studies would be needed to determine conclusively whether walking to school is really a valid index for a higher overall activity level, and whether this relationship varies with age and sex. Walking to school may be one way of getting children and their families to incorporate more exercise into their daily routine.

The importance of physical education in school has been repeatedly stressed, and there is no doubt that instruction in sports can increase children's enthusiasm for sporting activities (e17). Physical education can also teach children the basic principles of motor activity, not specifically relating to sports. Nonetheless, the relevance of physical education in school to the overall daily level of physical activity remains unclear. A study of nine-year-olds showed that the overall activity level of children in different schools – measured by accelerometry – was no different, despite major differences between schools in the number of hours of physical education per week. Children who had only a few hours of physical education compensated for this with more physical activity outside school (e13).

The studies performed to date have shown that all short- and long-term interventions should be thoroughly evaluated. This is particularly true of proposed interventions in younger children, whose activities, such as unstructured play, are difficult to document quantitatively.

Current recommendations from the United Kingdom and the United States are that children should engage in moderately or highly strenuous exercise for at least 60 minutes per day. Children's physical activities should be both enjoyable and varied (9, e18, e19).

The relationship of exercise to the development of obesity

Most studies objectively measuring levels of physical activity are cross-sectional studies comparing the activity of overweight and non-overweight children. Such studies cannot definitively demonstrate a causal relationship between the lack of exercise and the development of obesity. The few prospective studies performed to date have concerned prepubertal children and have not shown a consistent relationship between physical activity and obesity (e17, 10).

On the basis of studies by Dietz, Gortmaker, and colleagues, which showed a significant association between the development of obesity and high levels of television-watching, Marshall et al. (2004) performed a metaanalysis of studies (11, 12, 13). The metaanalysis included 33 studies, 8 cross-sectional studies, and one randomized, controlled trial (RCT). No significant correlation was found between body fat and the time spent in front of the television, computer, or video games; nor was there any significant dependence of the amount of body fat on the relative amounts of sedentary behavior versus physical activity. It should be said, however, that the studies that were assessed employed very diverse methods of documentation, e.g., with regard to the definition of obesity, or to the assessment of physical activity by self-reporting or objective measurement. One may conclude from this meta-analysis that the development of obesity requires not just the key factors television-

watching and inactivity, but also further factors such as the reception of advertising messages for high-caloric foods and the consumption of high-caloric snacks in front of the TV set.

It has been clearly shown, however, that television-watching is the main leisure activity among children and adolescents today. The average child in the USA watches television for 2.5 hours per day, which is ten times as long as he or she engages in intense exercise (e20). According to a recently published study on the long-term effects of television-watching, nine-year-olds watch television for an average of 2.2 hours per day, while 15-year-olds watch television for nearly 4 hours per day (e21).

Opportunities for intervention

The need for exercise in the treatment of obesity is evidence-based. Only the treatment groups in which emphasis was placed on exercise had a significant reduction of body fat and an improvement in fitness (e22, e23, e24).

Physical activity thus seems to be of crucial importance both for the treatment of obesity and for the long-term development of an appropriate body weight in children and adolescents (e25). The favorable effect of exercise on physical fitness and body composition during treatment has been confirmed by many studies (e23, 14, e26, 15).

An essential factor for this favorable effect is that all everyday activities should be pursued actively rather than passively, e.g., walking or bicycling (rather than riding in motorized vehicles), climbing stairs, or playing outside. This has a greater preventive or therapeutic effect against obesity than participation in organized sports (16).

The therapeutic programs that have achieved the best results to date applied a combination of physical exercise, nutritional counseling, and parental involvement (17, e27, e28, e29, 18). Although a child's degree of willingness to exercise is partly genetically determined, the parents' personal influence on exercise and nutritional behavior is decisive (e30, e31, e32, e33, e34). Maffeis et al. showed that the weight of the parents strongly predicts the future weight of their child (19).

Moreover, social status also plays an important role in the development of obesity in childhood. Children from lower, less well-educated social strata are at greater risk of becoming obese (e35, 20) and are therefore in need of special attention. Parents from higher social strata seem to be better able to support their children effectively because of their greater resources, both cognitive and financial (21). Flegal even found that factors such as parental income and educational level played a more important role in the development of obesity, and in its treatment, than exercise and nutrition (e36). Environmental factors (mainly the social environment) exert a major influence on everyday activities (e37, 22). In general, too, parental physical activity is a strong positive predictor of children's physical activity (e38). Moore et al. found that children of athletic fathers were three times as active as children of inactive fathers (23). Maternal athletic fitness also had a positive, though less intense, effect on children's physical activity.

Sports programs for overweight children

Most studies in which successful weight reduction, or the maintenance of a normal weight, was achieved have laid emphasis on regular physical activity during the treatment program (e39). In children (particularly overweight children) as in adults, regular physical activity helps prevent illnesses such as diabetes, hypertension and arteriosclerosis and also improves social competence through participation in group activities (24). Attention must be paid to children's motor development, because obese children have a generalized deficit in this area, as has been shown by the Kippard coordination test (Koordinationsstest nach Kippard, KTK), the general motor test for sports (allgemeiner sportmotorischer Test, AST), and the Munich fitness test (MFT) (e40). The deficit particularly affects aerobic endurance and motor coordination. Overweight children still possess good individual coordination skills, but they carry out complex motor tasks much less well than children of normal weight (e40, e41, e42, e43); often, they lack practice in these tasks for long periods of time because of their excessive weight. Sports programs for overweight children must take account of these deficits and, above all, motivate them to spend their leisure time actively, because this is the only effective way to manage obesity – a chronic illness – over the long term (22).

Generally speaking, however, overweight children and adolescents do not want to

exercise merely to lose weight or for other health-related purposes. Physical activities for this age group should be fun and feasible within the lifestyle of the child and his or her family. Long-term maintenance of a new, active lifestyle is possible only if children enjoy the activities in which they participate and derive a better quality of life from them (e44, e45). Diversified daily activities and games involving exercise that improve physical performance are easier to integrate into children's and adolescents' routine than participation in organized group sports. Thus, treatment programs must also inculcate motivation for physical activity, a little bit at a time. The essential goal is to reduce sedentary activities outside school to less than two hours per day (e46).

Future prospects

Because of the increased prevalence of poor nutrition and the declining levels of physical activity in recent years, large-scale preventive measures are needed. The training of very young children in proper exercise and nutrition has long been neglected (9). There are only limited reliable data, however, on the effectiveness of programs to prevent obesity, and no general conclusions can be drawn on this subject (25). It nonetheless seems highly advisable to teach children as early as kindergarten how to deal with their own bodies responsibly. The promotion of early motor development, and schooling in nutrition, would be helpful to achieve this goal (e47).

Conflict of Interest Statement

The author declares that that no conflict of interest exists according to the Guidelines of the International Committee of Medical Journal Editors.

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