Childhood Obesity

The Role of Physical Activity

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Childhood obesity has presented itself as a major health problem in developed nations. In the last 20 years the childhood obesity rate has dramatically increased and in the United States 16% of children are now considered obese with an annual increase of around 1%. Similar trends have also been observed in other countries such as the United Kingdom and Australia despite a variety of measures being adopted to address the problem. These include healthy eating promotions such as the “2 Fruit and 5 Vegetable” and “Life Be In It” physical activity campaigns adopted in Australia aimed at the general population. Negative trends are evident in all developed nations and disturbingly this decline is now appearing in developing parts of the world. For example, China with nearly a quarter of the world’s population has childhood obesity rates as high as 20% in some regions.

Obesity in childhood is commonly defined by a body mass index (BMI) at or above the age and gender related 95th percentile. Overweight children would typically fall between the 85th and 95th percentile. These relative measures are considered more accurate in children than absolute BMI measures such as a figure of 30 and above for obesity when used in adult populations. This is due to the ongoing and rapid physiological changes still occurring during maturation having great impacts on body fatness measures. For example a child with a BMI of 30 would normally be classified as obese under adult classifications. Although no intervention into the treatment of the condition may be initiated a reduction in BMI may be observed as part of a normal increase in height. Additional measurements such as waist circumference have also proven to be helpful in determining obesity as abdominal subcutaneous and visceral fat deposits are important indicators of health risk.

Current physical activity recommendations to combat the childhood obesity epidemic vary and may to some degree add to the problem. This lack of clarity in guidelines may contribute to a disjointed approach being adopted worldwide but also fuel more confusion amongst children, parents and even health care professionals. Some major guidelines are summarised in the table below.
Interestingly these recommendations have greatly increased over the last twenty years and it can be speculated that this is a direct result of previous guidelines being ineffective in arresting the upward movement in childhood obesity rates. Whilst these recommendations may vary there is a general consensus that to produce significant reductions in weight status requires a greater level of physical activity than that required to produce health benefits alone (Jakicic & Otto, 2005). This may partly explain why adherence to interventions involving physical activity are sometimes adversely affected as improvements in health markers such as blood pressure and cardiovascular fitness may be evident but noticeable and visible changes such as a reduction in weight status may have still not occurred.

In a study by Gordon-Larsen and colleagues (Gordon-Larsen, Nelson, & Popkin, 2004) it showed that most children fail to meet physical activity recommendations by adolescence and a declining trend is evident into adulthood. Subjects were considered to meet guidelines if performing at least five or more sessions of moderate to vigorous activity each week. Similar findings were also reported in a recent study by Riddoch and colleagues (Riddoch et al., 2007). A large cohort of 5595 children aged 11 years was monitored over a seven day period. Apart from a general failure to meet recommended levels of activity a greater decline in girls was also evident.

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Target Group</th>
<th>Recommendation</th>
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<tbody>
<tr>
<td>American College of Sports Medicine (ACSM) and American Heart Association (AHA)</td>
<td>Healthy adults under age 65</td>
<td>Do moderately intense cardio 30 minutes a day, five days a week or Do vigorously intense cardio 20 minutes a day, 3 days a week and Do eight to 10 strength-training exercises, eight to 12 repetitions of each exercise twice a week</td>
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<tr>
<td>Centers for Disease Control and Prevention (CDC)</td>
<td>Children and adolescents</td>
<td>Participate in at least 60 minutes of moderate intensity physical activity most days of the week, preferably daily</td>
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<tr>
<td>Australian Government</td>
<td>5-12 year olds</td>
<td>Children should participate in at least 60 minutes (and up to several hours) of moderate to vigorous intensity physical activity every day</td>
</tr>
<tr>
<td>Institute of Medicine</td>
<td>Adults</td>
<td>60 to 90 minutes of daily physical activity</td>
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Two important factors that are contributing greatly to the childhood obesity epidemic are increased caloric intake and a reduction in physical activity levels. Other factors include hormonal dysfunction such as hypothyroidism, hypothalamic-pituitary diseases, pseudo hypoparathyroidism and genetic defects like Prader-Willi syndrome. However these only account for a small percentage of childhood obesity cases (Singhal, Schwenk, & Kumar, 2007) of possibly up to 2%. Lower education and parental obesity have also been linked to childhood obesity (Strauss & Knight, 1999). Interestingly a reduced calorie intake from previous generations has been observed yet children are more obese (Boreham & Riddoch, 2001). This may be attributable to the differing composition of diet characterised by a greater proportion of energy derived from fat.

Physical activity levels have however dramatically decreased and whilst only a small reduction in daily activity may be noticed, this has significant effects when considered over an extended period. Gains in weight are usually gradual in nature and accumulated over a number of years. For example a 100 kilocalorie reduction in energy expenditure, equivalent to maybe a 20 minute walk, may result in a weight gain of 5kg over just 1 year. This may explain to some extent the lack of strong political will to address the issue as changes are not immediately noticed or even associated with this reduction in physical activity.

**Impact of Childhood Obesity**

Childhood obesity poses great problems as adult health status may to a significant part be determined in childhood (Boreham & Riddoch, 2001). The effect of consequent morbidities in latter life may be prevented or reduced in childhood. For example, coronary heart disease (CHD) has been positively linked to those persistently overweight (Gunnell, Frankel, Nanchahal, Peters, & Davey Smith, 1998). Freedman and colleagues (Freedman, Khan, Dietz, Srinivasan, & Berenson, 2001) also found that CHD risk was significantly increased for subjects obese in both childhood and adulthood. Only 7% of normal weight children developed into obese adults. This perhaps emphasizes the need for prevention strategies to target at risk
Cardiovascular disease risk factors are also now being more frequently observed in obese children. These include hypertension, dyslipidemia and elevated blood pressure. A grouping of these conditions, referred to as metabolic syndrome or syndrome X have been reported in children as young as 5 years of age. The prevalence of type II diabetes, once referred to as adult-onset diabetes, may now be as high as 50% amongst children in some societies. A sobering thought is that if obesity trends continue there exists the real chance of a generation of children dying before their parents.

Childhood obesity also presents many other complications of a physiological and psychological nature. Physiological problems include inability to perform normal physical activities during school time such as a simple jog around a track during physical education class. This itself may lead to psychological problems of anxiety, stress, and reduced social interaction. Further implications manifesting in reduced physical activity levels may result leading to increased obesity risk.

Negative psychological effects have also been reported as a result of childhood obesity (Hesketh, Wake, & Waters, 2004). Results showed a strong link between low self-esteem and being overweight in 5 to 10 year old children. Overweight children have also been found to be less popular when compared to their normal weight peers (Strauss & Pollack, 2003). It was also reported in this study that those who nominated overweight children as friends tended also to be less popular themselves. Peer pressure to conform to perceived acceptable standards relating to body image should not be understated. Overweight children seeking social acceptance are susceptible to enormous pressures and may adopt unsafe and quick fixes to address their weight issues. This may include unhealthy dieting, bulimia and anorexia nervosa.

Financial costs to society are ever increasing and are of major concern. Public health systems around the world are often stretched to meet the demands of an increasingly
older population but this is further exacerbated by the predominance of sedentary lifestyles creating a clustering of chronic disease risk factors amongst increasingly younger populations.

Early screening to recognise overweight children may be of value. However this may have the social stigma of branding a child early in life with possible counter productive effects. Many parents may also be reluctant to admit to having an overweight child. This may be due to feelings of guilt or possibly failure as it might be perceived that they have neglected their child in some way and this has contributed to their problem. These negative connotations must surely be avoided as they only risk further alienating both child and parent. A collective community responsibility for this epidemic must be taken to encourage a friendly atmosphere where help is readily sought. Children and parents may also be unaware of any abnormality in relation to weight status. One possible reason for this may be attributable to the increasing obesity trend whereby children of normal weight status may be in the minority and overweight may be the new “normal”. More clear markers need to be set to establish an up to date reference model for a healthy child (Ruxton, Reilly, & Kirk, 1999).

**Benefits of Physical Activity**

Physical activity plays a major role in the reduction of childhood obesity rates. Apart from a reduction in weight status, there may be improvements in health risk factors such as lipid profile, blood pressure, improved cardiorespiratory fitness, enhanced musculoskeletal fitness and increased bone density.

It should also be noted that physical activity may not always lead to reduction in weight. However a reduced risk of especially cardiovascular disease may still be evident.

Comparisons between dietary modifications and physical activity interventions have also shown a greater health benefit with activity. For example, a reduction in weight status may be observed in both dietary and physical activity interventions but an
accompanying improvement in cardiovascular fitness may also be noticed with physical activity. Dietary changes may also not be advisable for many children as these frequently may involve a reduction in caloric intake which risks comprising adequate nutrition during the child’s growth phase.

A reduction in blood pressure from a physical activity intervention in adolescent girls has also been observed (Ewart, Young, & Hagberg, 1998). This involved an aerobic-based school physical activity program conducted over an 18 week period. It is also worthy to note that a large proportion of participants also expressed an interest in continuing with a similar program if academic credit was available.

Childhood activity may also delay or prevent onset of certain chronic diseases. Increased bone mass in childhood reduces the risk of osteoporosis in later life. Children also may be more self-confident and academic benefits may also be apparent.

Factors Affecting Physical Activity
Factors need to be considered in regards producing environments that are conducive to children becoming or remaining active. The prevalence of varied sedentary choices for leisure time activities such as video games, computer use and television watching with a concomitant reduction in choices for active pursuits is further increasing the positive energy balance. Children may be discouraged or prevented from being physically active by many variables. This may include proximity to play areas which if too far away may promote indoor activities which are more likely to be of a sedentary nature.

Children are also less likely to walk or cycle to school in areas without adequate footpaths. This is of great significance as it translates into a substantial amount of activity. For example, walking or cycling to and from school over a five day week would equate to an extra ten bouts of physical activity per week (Tudor-Locke, Ainsworth, & Popkin, 2001). In an interesting study by Liu and colleagues (Liu, Wilson, Qi, & Ying, 2007) a positive influence on physical activity with greener
environments was reported. Mechanisms behind this may be varied but it was speculated that the shade from trees together with natural scenery encouraged more people to walk (Sallis, Caparosa, Nichols, Johnson, & Calfas, 1997).

Not surprisingly television watching has also been assumed to have a detrimental effect to physical activity. This has been speculated to increase the time devoted to sedentary behaviours which consequently contribute to a reduction in physical activity time (Andersen, Crespo, Bartlett, Cheskin, & Pratt, 1998). However findings have been inconclusive and studies reporting reduced television time have conversely not shown any significant increases in physical activity levels (Robinson, 1999). However significant reductions in BMI were reported as a consequence of better eating habits linked to reduced television time. Interventions with increased physical activity have also been conducted with no reported significant reduction in television viewing (Nemet et al., 2005).

In addition to television viewing time other electronic entertainment such as computer use and electronic games must also be considered. In a study by Spinks and colleagues (Spinks, Macpherson, Bain, & McClure, 2007) it was reported that over a third of 5 to 12 year old children exceeded Australian electronic media guidelines of 2 hours daily. This correlated to an increased risk of obesity. Interestingly a significant association was not also evident between those participants not meeting physical activity guidelines of 60 minutes daily and obesity. This might be explained by the accuracy of activity levels which was recorded by parents.

Adherence to physical activity programs in the general population normally shows a marked reduction after around 6 months. This drop-off is even more marked in children and one factor which may be speculated to be of utmost importance would be enjoyment of exercise. Overweight or obese children have been reported to have less enjoyment with exercise and find it more difficult compared to their normal weight counterparts (Trost, Kerr, Ward, & Pate, 2001).

In a recent study (Snethen & Broome, 2007) children of ages 8 to 12 years were
questioned on their attitudes and perceptions towards weight, exercise and health. Views expressed an importance on the social aspects of exercise and being with friends. Subject also cited teasing as a problem when in a group situation. This may be overcome through complementary individual sessions but unfortunately there is a lack of research into children’s attitudes to physical activity when in group and individual sessions.

Personalised exercise programs under the framework of national guidelines may be beneficial. A monitor on intensity of exercise may be advisable to ensure comparable energy expenditure. Differing modalities of physical activity may have a positive effect when tackling the problem of program adherence. American College of Sports Medicine recommendations also advise that an accumulation of daily exercise time via more than 1 bout of exercise per day but of at least 10 minutes as an alternative to 1 longer session per day. In a study by (Quinn, Klooster, & Kenefick, 2006) results showed an equal if not greater effect from 2 by 15 minute bouts of exercise per day when compared to one single 30 minute bout.

Traditional thinking has recommended at least 30 minutes of continuous exercise per day to obtain cardiorespiratory improvements. Children are generally active but continuous exercise bouts of less than the prescribed duration are preferred and more often adopted. This may be due to a variety of factors such as fatigue, boredom and a preference for a more varied routine to enhance enjoyment and fun.

During childhood much behaviour is naturally dictated by parental involvement and attitudes. Clearly dietary habits are a good example in developed nations where most children would naturally not have to provide their own meals. Physical activity levels have also been positively linked to a parent’s role (Fogelholm, Nuutinen, Pasanen, Myohanen, & Saatela, 1999). In this report physical activity was found to correlate strongly with parent and child but this was not as marked when vigorous activity levels were considered. Parental physical education classes may be of some benefit. These may assist the child in combating obesity but also help adults at risk. There is a clear dose response relationship between physical activity and childhood
obesity. However no clear findings have recommended the appropriate amount of exercise required to initiate a reduction in obesity rates. It can be speculated that high doses of physical activity may indeed produce better results although adherence to program may be affected negatively with high intensity exercise.

Differences in approaches for boys and girls (McMurray et al., 2000) may also be advisable. This may include varying intensity of exercise but also types of exercise to attain most beneficial long term results.

**Types of Physical Activity**

Most literature would recommend some form of aerobic work to reduce childhood obesity. This may be in a variety of different forms but common types would include that of running, swimming and cycling. Supervised interventions including aerobic work have reported significant reductions in BMI (Nemet et al., 2005). Parental involvement with their child’s physical activity may then serve to be beneficial for three reasons. Firstly, this may be one of education for both the parent and child, secondly for supervision of a program and thirdly as a bonding exercise to increase moral support and ideally have positive effects towards program adherence.

The other major form of physical activity recommended is that of strength or resistance work. Whilst controversy still exists on the efficacy of this for children many studies have shown positive results. Benefits include improved strength, sports performance and bone density. Types include traditional weight training, plyometrics, body weight exercises and more novel approaches such as the use of medicine balls in exercise routines that have produced good results when compared with more traditional forms of activity (Faigenbaum & Mediate, 2006). Overweight or obese children may also find this form of activity more appealing due to their sometimes greater natural strength.

Positive psychological effects and attitudes towards exercise should also be considered in addition to physiological benefits when planning effective and long lasting interventions as they further promote involvement and social interactions.
during physical activity.

**Intensity of Exercise**

Intensity of exercise plays an important part not only to program adherence in childhood but also in producing optimal results without overtraining. Health benefits may be noticed with more moderate levels of physical activity although more vigorous levels have been associated with better results in reducing childhood obesity (Ruiz et al., 2006). The right balance between intensity and program goals needs to be addressed but initial levels would be recommended to be more conservative bearing in mind the age and health status of this population group.

**Measurement of Physical Activity**

An important part of any intervention to reduce childhood obesity is to accurately gauge it’s effectiveness. Measurement of physical activity levels of children has always presented as a problem and a variety of measures have been used in studies to date. These include physical activity level (PAL) and metabolic equivalents (METS). Measurement devices or tools include heart rate monitors, pedometers, accelerometers, rating of perceived exertion (RPE) and activity journals (Spinks, Macpherson, Bain, & McClure, 2007). More objective measures such as heart rate monitors have had some success in more accurately recording activity levels in children as not being solely reliant upon a child’s or parent’s recording. The variety of activities engaged in by children, many of which may be of small durations, is a contributing factor in measurement error.

More precise measures of physical activity levels are perhaps required (Trost, Kerr, Ward, & Pate, 2001) to enable a more targeted and appropriate response to the childhood obesity rate.

**Types of Physical Activity Interventions**

Interventions may be classed into two main areas. These are treatment and preventative strategies. Treatment options may also require more specialised help from medical practitioners, dieticians and perhaps psychologists. The already obese
child may present with associated health risks which clearly need to be diagnosed to properly devise any treatment strategy. Preventative measures are clearly desirable as being able to combat the childhood obesity problem before any health risk markers are evident. Typically children overweight but not obese may be targeted. This does not suggest that obese children refrain from participation in any broad based prevention strategy but rather a level of moderation and possible medical clearance be obtained before starting such a program.

Prevention strategies may be further categorised into school, family and community based approaches. School based programs may also involve simple modifications to game play to increase child involvement and also increase intensity levels. School based programs have shown promising results but long term effectiveness of these programs requires a considerable amount of more quality research. However, these may be advantageous as child involvement including peers can serve as a motivational tool.

Family based interventions typically target both parent and child and programs could include simple family education classes. These are usually fairly quickly established and offer simple and effective means to increase activity rates whilst also being very cost efficient.

Community solutions may involve major changes to urban planning, environment and social interaction within neighbourhoods. This may include involvement by various people or bodies within a community and has the potential for long-lasting effects being focussed on a significant number of children. However, generally interventions of this sought are more costly, may take longer to implement and outcomes are more difficult to assess.

Physical activity programs may be further sub-classed to include those of a structured and unstructured nature. Structured programs may include a defined number of sessions per week for a set duration of specific types of exercise. These may also be supervised by someone such as a personal trainer or just a training partner and may
also be conducted at a gymnasium or health club. Advantages of this type of program may be that of safety but also motivation. Supervision or partnering of sessions may create a safer environment as any mishaps can be attended to but moral support may also help with motivation to adhere to an exercise regimen.

Unstructured programs may include lifestyle changes incorporating physical activity into one’s daily activities. For children this might involve walking to school as a replacement to catching the bus or being driven. Other activities include basic chores such as hanging out the washing, cleaning floors, gardening and walking the dog. These activities are all preferable over structured programs when cost factors are considered.

**Conclusion**

Existing measures used to combat the childhood obesity epidemic have been to a large extent ineffective. The negative trends observed globally present an enormous challenge. The rapid economic development of China and India, which contribute over a third of the world’s population, will surely only exacerbate the global problem through large scale environmental changes perhaps further decreasing physical activity rates.

Activity promotions to date have been generally of a broad nature and aimed at the general population but perhaps more focussed campaigns at children may be advisable to address the obesity problem.

Whilst benefits of exercise are regularly advertised perhaps a more graphic and negative approach may be adopted such as those used in anti-smoking campaigns. Promotion of the detrimental effects such as heart attack, type II diabetes and their affects on morbidities may deserve some consideration.

There is a limited amount of public funding available for such measures and unless there is a strong enough political will exhibited by governments worldwide this
shortfall will continue into the future and surely hamper large scale innovative and effective approaches to be adopted. In the meantime money may be more wisely spent tackling the problem early on as a preventative measure when fewer if none of the adverse health effects are evident.

There is an insufficient amount of currently published interventions that show long-term results (Reilly & McDowell, 2003). This is remarkable when considering the substantial costs to society attributable to obesity (Summerbell et al., 2005). A lack of precise data showing direct or indirect financial costs of childhood obesity may explain this imbalance. An increase in controlled longitudinal research is recommended together with more large scale longitudinal studies investigating associations between fitness, health and activity (Boreham & Riddoch, 2001).

The enormous challenge that childhood obesity presents together with the numerous flow on effects to all facets of society may in itself be contributing to the lack of a coordinated approach from local, regional and national bodies.

A more broad and government based approach needs to be implemented that encompasses the most simple and effective measures. These should include measures involving well coordinated school, family and community measures to address the problem. Children require a variety of choices and ease of accessibility for physical activity options. These options should also be enjoyable and fun for participants and encourage long-term adherence by addressing many social aspects of exercise.

Environmental factors also need to be addressed to gain long term significant results from significant public health initiatives (Ebbeling, Pawlak, & Ludwig, 2002). Urban planning may include measures such as more cycle and walking paths to promote a more physically active community together with greener environments which may also encourage long-term lifestyle changes to better tackle the childhood obesity epidemic.

Contributions from parents, teachers, medical practitioners, businesses and entire
communities need to be collated in a cooperative manner to ensure physical activity interventions are not only effective but durable. Mechanisms also need to be put in place whereby programs can be continually revamped, added to or even cancelled, if appropriate. This should involve continual feedback from all parties concerned but most importantly and often neglected are the opinions and perspectives of the children themselves.

References


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