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Review Article

Prevention of overweight and obesity in preschool children: an updated review

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ABSTRACT

An increasing number of children are becoming overweight and obese. Overweight and obesity are arbitrarily defined as excess adipose tissue in the body. Although many risk factors for overweight and obesity have been identified for school-age children, less is known for preschool children. Prevention of overweight and obesity in preschool children is an international public health priority given the significant impact of obesity on acute and chronic diseases, general health, development and well-being. This review was performed to study determinants and risk factors for overweight and obesity development in early age, effectiveness of preventive strategies in preschool children and outcome measurements of intervention programme in preschool children.

Keywords: Preschool children, Overweight, Obesity, Prevention

INTRODUCTION

Childhood obesity is a challenging multifactorial health problem that is escalating at an alarming rate across the globe. It is a major public health issue in most developed countries. With rapid urbanization and industrialization, this rapidly growing epidemic is also seen in many developing countries.[1] Furthermore, it is affecting more and more children in the first decade of life. Although many risk factors for overweight and obesity have been identified for school-age children, less is known for preschool children. The terms overweight and obesity refer to excess in body weight relative to height. Overweight is defined as relative weight upto 20% above normal (25 to 30 kg/m^2) and obesity is relative weight 20% above ideal body weight (>30 kg/m^2).[2] Recent data from National Health and Nutrition Examination Survey (NHANES) showed that 26.7% of 2 to 5 year olds were either overweight or obese.[3] In 2010, National Child Measurement Programme data from UK showed that 23% of children aged 4-5 years were overweight.[4] In USA, the prevalence of overweight was 32% and obesity was 17%.[5] In India, the prevalence of overweight in children ranges from 9% to 27.5% and obesity ranges from 1% to 12.9%.[6]

The increasing problem of overweight and obesity in preschool children is mainly due to modern lifestyle which promotes an imbalance between energy intake and energy expenditure, resulting in excessive fat deposition. There is evidence that weight at 5 years of age is a good indicator of the future health of a child,[7] and that obesity during childhood increases the risk of adulthood obesity which is associated with various morbid conditions such as type 2 diabetes, coronary heart disease, hypertension, dyslipidemia, etc.[8] It is also associated with introverted personality and behavioral problems such as anxiety, withdrawal and depression.[9] Furthermore, severely obese

children have significantly higher levels of multiple inflammatory markers.[10]

This review was performed to study determinants and risk factors for overweight and obesity development in early age, effectiveness of preventive strategies in preschool children and outcome measurements of intervention programme in preschool children.

POTENTIAL RISK FACTORS OF OVERWEIGHT AND OBESITY IN PRESCHOOL CHILDREN

In order to develop effective strategies for preventing childhood obesity and its health consequences in future, the risk factors of childhood obesity need to be identified as early in life as possible. The preschool years are a crucial time to study the determinants and risk factors of childhood overweight and obesity.

During perinatal life, the breastfeeding is found to be beneficial on infant's health because of its nutritional, immunological and psychological advantages. In a prospective birth cohort study based on 568 preschool children, Caleyachetty et al. found that breastfeeding was associated with a reduced risk of high BMI and the effect was strongly duration-dependant.[11] This suggests that breastfeeding has a potential public health benefit in preventing childhood obesity. Recently published data from Early Childhood Longitudinal Study (ECLS-B) based on 14000 young children showed that the formula fed in the first weeks of life and weight gain from birth to 9 months were significantly associated with the development of severe childhood obesity.[12] Since the weight gain during infancy may contribute to later metabolic and anthropometric programming, rapid weight gain during infancy may be a good predictor of overweight during childhood.

Sometimes, childhood overweight and obesity has its origin in early life. Barker's fetal origin hypothesis support the idea that low birth weight due to malnutrition in utero is associated with greater central adiposity, obesity and insulin resistance later in life, and an increased risk of health problems such as coronary heart disease, stroke, type 2 diabetes and metabolic syndrome.[13] Interesting information was found from a study in China by Zhou et al. which reported that fetal musical education was an independent risk factor for preschool child obesity.[14] It was reported that prenatal exposure to music and voice indirectly increases the fetal nutrient and oxygen supply and thus increases the fetal weight. Playing music also improves pregnant women's diet and sleep quality thereby increasing the pregnant women's weight which is associated with an increased risk of childhood obesity. Thus, both maternal and fetal factors may explain the effect of fetal musical education on childhood obesity.

In a prospective Generation R study by Heppe et al. based on 3610 preschool children, it was found that high birth weight, high maternal and paternal BMI and low family household income were significantly associated with the development of overweight in preschool children.[15] In low income families with fewer financial resources, children spend maximum time in front of the television and increased television watching is a significant risk factor of overweight and obesity in children.[16] Furthermore, the increased TV viewing is associated with increased consumption of snacks including high-fat foods and soft drinks which ultimately results in overweight and obesity in children. However, it is not clear whether the same is true in preschool children with some studies reporting no association and others a positive association. If an association does exist, it is likely to operate through a combination of multiple factors such as reduced physical activity, increased exposure to advertisement on unhealthy foods and snacking during television watching. Some study findings support the idea that childhood overweight has multiple determinants. It was found that the main determinant may vary by different age group. In preschool children it may be the level of mother sensitiveness but in school children the most important factor is time spent at television watching after school.[17] A positive relationship of childhood obesity was also reported with maternal smoking during pregnancy.[18] Low maternal education and high levels of television watching by young children were other significant risk factors of overweight and obesity.[19] These findings suggest that it may be particularly important to target low income families and less educated mothers for health promotion intervention in reducing overweight and obesity in preschool children.

The impact of sleep duration on obesity risk in young children is considerable and is similar to other known risk factors for overweight. In a Synergistic Theory and Research on Obesity and Nutrition Group (STRONG) Kids study by Dev et al., a positive association was revealed between short sleep duration (less than 8 hours) and obesity risk in preschool children.[20] which indicates that sufficient sleep is essential for the prevention of obesity in younger children. Therefore, increasing awareness of parents on the importance of sleep and helping them to establish an appropriate sleep schedule for young children may be useful in preventing childhood obesity.

A cross-sectional study was conducted by Gilmar et al. to assess the factors associated with overweight in children under 4 years.[21] The authors found that maternal employment at 4 months of age was associated with early childhood overweight. Generally, children whose mothers start working early during postpartum are weaned sooner and exposed earlier to foods that are consumed by the rest of the family, which makes them more susceptible to overweight. In addition, working mothers tend to please the child with high-energy foods such as cookies, chocolates and salty snack foods to make up for her absence due to work.

Parental perception of child's weight status also plays an important role in identifying overweight and obese children. In a population-based longitudinal study, nearly 75% of mothers of overweight children considered their children to be normal or underweight.[22] Keeping this in mind, prevention and treatment of obesity in young children should use multifaceted family based programs with parental involvement. Parents are not only responsible for determining the activities that young children engage in during their free time but also for creating an active lifestyle in their household that minimize sedentary behaviours in children.

There is some influence of availability of neighbourhood playground on childhood overweight.[23] It was observed that 3 year old children were more likely to be overweight if they did not have access to a nearby playground suggesting that limited opportunities to be outdoors in close proximity to their home may reduce young children's physical activity levels. Children's physical activity levels are also affected by parental perceptions of the neighborhood safety which is inversely related to increased television viewing by young children.[24]

Risk factors of overweight and obesity among preschool children are complex as they are related to individual, family and society. These risk factors sometimes also related to cultural factors in a society. In a case-control study by Thongbai et al. based on 615 preschool children, it was found that boys were at a higher risk for being overweight than girls.[25] There are studies, however, that have found preschool girls were more at risk for being overweight than boys.[26] This difference in risk between boys and girls may be due to cultural factor. For example, Hispanic and Asian families traditionally place higher value on sons which may account for early differences in parenting practices to ensure sons' health and survival.[27]

The Canadian pediatric society[28] advocated that all pediatricians should measure weight and height of young children to screen for underweight, wasting, overweight and obesity. However, in many countries, this is not a routine clinical practice. The American academy of pediatrics[29] recommended that pediatricians should calculate and plot BMI every year for all children to check for excess weight gain in children of all ages. BMI plotting helps in early recognition of children at risk for obesity. Although pediatricians routinely measure height and weight, only few of them (6%) actually plot BMI for children. Besides, there is evidence that both in UK and USA health care providers are reluctant to diagnose obesity in infants.[30] As a result, pediatricians may fail to identify children with mild obesity and miss the opportunity to intervene early in the course of the disease. By monitoring BMI for all children, pediatricians and other health care professionals can play a significant role in preventing overweight and obesity among young children.

There is a great scope for addressing childhood overweight and obesity in child care setting as more and more children are in child care facilities today than ever before. At the time of issuing license to child care centers, USA set regulations in 36 states that child care centres should engage children daily in outdoor activity for at least 60 minutes. Despite the licensing regulations, only 9 states set specific minimum time for outdoor activity, 12 states had regulations that limited foods of low nutritional value and 8 states regulated time limits on television watching per day.[31] Therefore, child care practitioners, health professionals, state policy makers and state licensing officers need to work together to develop nutrition, physical activity and media use policies and regulations that will prevent childhood obesity without placing undue administrative or financial burden on child care facilities.

To summarize, the commonly identified potential determinants and risk factors of overweight and obesity in preschool children are: high birth weight, rapid weight gain during infancy, poor breastfeeding, early introduction of weaning foods, high maternal and paternal BMI, maternal employment, maternal smoking, low income family, increased television viewing by young children, lack of safe playground in the neighbourhood, parental perception of child's weight status, lack of physical activity, poor dietary habits (excessive intake of high fat foods and sugary beverages), cultural factors and political factors.

EFFECTIVENESS OF PREVENTIVE STRATEGIES IN REDUCING OVERWEIGHT AND OBESITY IN PRESCHOOL CHILDREN

Intervention for the prevention of obesity in preschool children is gaining increasing attention from researchers as evidenced by the rapid increase in publications in recent years. Several studies were carried out to assess the success of interventions in preventing childhood obesity, but showed mixed results.

The recently published Cochrane review presented 8 studies that demonstrated the effectiveness of interventions in reducing obesity in preschool children.[32] The positive impact was captured in only one study which reported significant higher performance in movement skills tests in the intervention group than in the control group. Dietary changes were reported in two studies which revealed lower intake of saturated fat in the intervention group than in the control group. The similar results came from a centre-based randomized controlled trial by Elder et al. that reported lower consumption of fat and sugary beverage in the intervention group than in the control group.[5] Although, these data cannot tell us why these particular behaviours appeared to change, it is possible that reducing fat and sugary beverage consumption are relatively easy behaviours for families to implement compared with the more complex, multidimensional behaviour of physical activity. The

review of 29 studies that was published by Oxford University Press showed that school-based interventions targeting both physical activity and diet combined were associated with significant improvement in BMI.[33]

The Hip-Hop to Health Jr. randomized controlled trial that was conducted in minority preschool children in child care centers reported significant decrease in BMI and low intake of calories from saturated fat in the intervention group compared with the control group.[34] Similarly, "Eat healthy, stay active" study consisting of interventions in the form of educational programs and activities to promote healthy nutrition and physical activity for parents, staff and preschool children, showed a significant decrease in BMI in preschool children.[35]

The operation of markets has also contributed to the recent increase in childhood overweight in three main ways.[36] Firstly, energy-dense foods such as those containing fats and sugars became relatively cheaper than less energy-dense foods such as fresh fruits and vegetables. Secondly, rising wages have increased the "opportunity costs" of food preparation encouraging people to spend less time preparing meals. Finally, technological changes have created incentives to use prepackaged meals rather than preparing meals at home. Protecting children from advertisement on unhealthy foods, using taxes and subsidies to change behaviours associated with obesity and regulating the food environment in child care centres are examples of economic policies that may help prevent obesity among young children.

In a critical literature review that reported only 6 studies relevant to prevention of overweight in preschool children, the author observed that these studies had several limitations and the overall quality of studies was poor. The author concluded that there was a lack of comprehensive evidence on effective strategies to prevent obesity in younger children because of inconsistent results across studies.[37] On the other hand, the review published the same year that analyzed 9 studies was more optimistic.[38] While these studies varied widely in their objectives, design and quality, overall most studies were able to show some level of effectiveness of preventive strategies e.g. reduction in fat intake, reduction in total energy intake and reduction in television watching. Thus, there is an urgent need for the new, well designed preventive strategies targeting multiple behaviours to reduce overweight and obesity in preschool children.

OUTCOME MEASUREMENTS OF INTERVENTION PROGRAMME IN PRESCHOOL CHILDREN

The method of assessment of the effectiveness of intervention programmes is very important in preventing overweight and obesity in preschool children. In a 2-year community-based A Pilot Programme for Lifestyle and Exercise (APPLE) study, Taylor et al. reported that intervention children consumed more fruit and less sugary beverages compared to control children.[39] A randomized controlled trial conducted in USA showed that there was a significant reduction in television viewing and computer use in intervention group which had a beneficial effect on both behavioural outcomes (less sedentary behaviour and low energy intake) and anthropometrical measurements (decrease in BMI).[40] Consistent with the above study results, similar findings were reported by Haines et al. in Healthy Habits, Happy Homes study that was conducted in preschool minority children in USA. The study was effective in reducing subsequent increase in BMI and in lowering the calories intake from saturated fat.[41]

Hakanen et al. reported interested findings from Special Turku Coronary Risk Factor Intervention Project (STRIP) study which is a prospective, randomized trial aimed at reducing the exposure of the intervention children to the known risk factors of atherosclerosis.[42] From the age of 7 months, the intervention children received individualized counseling focused on healthy diet and physical activity biannually for 10 years. At 5 years follow-up, the intervention group had lower intake of saturated fat and lower lipid levels, and at 10 years, the prevalence of overweight was low in the intervention group, but only in girls, compared with controls with no differences between boys in either group. This study results suggests that the prevention of obesity in young children is not very difficult provided it is started at very early age. Recently published findings of randomized controlled trial by Alkon et al. showed that the intervention programme in the form of training provided by nurse child care health consultants significantly increased knowledge of parents and child care provider, improved the nutrition and physical activity written policies and decreased mean children's BMI in the intervention centers compared to matched control centers.[43] Therefore, more and more parents and health professionals should receive such training in child care which may be helpful in reversing the obesity epidemic in young children.

A cluster randomized controlled single blinded trial was conducted by Reilly et al. using enhanced physical activity programme and home based health education as the intervention, with the aim of increasing physical activity. It was demonstrated that children in the intervention group had significantly higher motor skills than in the control group but there was no significant effect on BMI.[44] Similarly, in 'Healthy & Ready to Learn' randomized controlled trial in four Head Start programs with a 24 week multi-level intervention programme comprising of parent and teacher education and child activities, there was no significant change in BMI in the intervention versus control group.[45] A systematic review by Monasta et al. which includes more RCTs than previously published systematic reviews and focusing exclusively on children under 5 years of age, showed no effect of intervention in reducing overweight and obesity or in limiting weight gain in preschool

children.[46] The LEAP2 randomized controlled trial by Wake et al. was carried out to reduce BMI gain in overweight or mildly obese young children who were identified through surveillance in primary care. It was also aimed to increase physical activity and improve child nutrition. This intervention study was conducted in family practices where children were offered 12 months long programme. Primary care screening followed by brief counseling showed no effect on BMI, nutrition or physical activity and the costs of the healthcare system were significantly higher in the intervention arm.[47] The limitation of majority of studies included were wrong choice of the measured outcome. Furthermore, the interventions were not carried out optimally. This suggests that the interventions should be compulsory or carried out for longer period of time with longer follow-up.

The review published in 2006 on children from 0 to 5 years was more optimistic.[38] Nine studies were analyzed that involved multi-approach interventions and varied in design and quality. All of them showed some level of effectiveness of preventive strategies and majority of them showed success in changing some behaviours in children e.g. reduction in fat intake, reduction in total energy intake and reduction in television viewing.

CONCLUSION

Overweight and obesity are man-made disease 'which often' starts in the womb and ends in the tomb. Several studies were carried out to identify risk factors of overweight and obesity amongst school-age children, but very few studies have been conducted for preschool children. The potential determinants and risk factors of overweight and obesity in preschool children that were identified in this review are: high birth weight, rapid weight gain during infancy, poor breastfeeding, early introduction of weaning foods, high maternal and paternal BMI, maternal employment, maternal smoking, low income family, increased television viewing by young children, lack of safe playground in the neighbourhood, parental perception of child's weight status, lack of physical activity, poor dietary habits (excessive intake of high fat foods and sugary beverages), cultural factors and political factors. Research is urgently needed on interventions in changing these potential determinants and risk factors. Diet, exercise and behavioural medication are important in the intervention. Prevention of overweight and obesity in younger children is not an easy task, but it could be more rewarding than in the older age group.

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