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IMPORTANCE OF PHYSICAL ACTIVITY IN OBESE CHILDREN IN RELATION TO MOTOR SKILLS: A SYSTEMATIC REVIEW

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ABSTRACT

Background: Childhood obesity has reached epidemic proportions worldwide and is associated with increased cardio vascular mortality and morbidity in adult life. In children, obesity correlates strongly with a progressive reduction in the level of physical activity and changes in food habits.

Methods: This study is a qualitative research study. A secondary data collection technique was utilized and conducted through a search of articles published between 2005 and 2014 in PubMed and Google scholar databases. The objective of the present study is to provide a systemic review of the available literature and outline the factors in early life that are associated with an increased risk of obesity in children there by leading to poor gross motor skill performance with the help of Anthropometric assessment, Body composition and Motor skills proficiency.

Results: Importantly recent studies have demonstrated that exercise training improves vascular endothelial function and stimulation of pressure receptors leading to increased vagal activity in obese children. The current literature highlights the importance of adding exercise programs to clinics, schools and families for the physical and psychological wellbeing of children.

Conclusion: Overall findings from the present review showed that normal children with physical exercise are more superior in motor skills compared to other peers. Results of the previous studies indicated that normal children's are more efficient in bilateral coordination in greater balancing, efficient upper limb coordination and greater strength.

Keywords: Children, obesity, physical activity, fine motor skills.

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INTRODUCTION

Obesity in childhood is becoming a major public health concern and anti-obesity treatments led to an array of diverse efforts aimed at promoting healthful eating and physical activity.¹ Although evidence is limited, physical activity in children may help control excessive weight gain and may help children maximize their developmental potential. As the relationship between motor skills and childhood obesity still remains unclear and limited. The review was conducted to produce a clearer picture in an attempt to expand the knowledge towards combating the prevalence of obesity among children's. Obesity is now considered a disease of epidemic proportions with increasing prevalence worldwide. Prevalence has increased substantially in children and adolescents in developed countries; 23.8% (22.9–24.7) of boys and 22.6% (21.7–23.6) of girls were overweight or obese in 2013.² This general rise in obesity is likely to have long-lasting physical and mental health consequences for the population. Metabolic syndrome comprises the grouping of cardiovascular risk factors, such as arterial hypertension, central deposition of body fat, dyslipidemia and insulin resistance.³⁻⁵ Obese children are more susceptible than lean ones to sleep-disordered breathing⁶ (e.g. obstructive sleep apnea). Children with coordination problems are more likely to have excess weight gain than children with better coordination.

METHODS

Research design

This study is a qualitative research study. A secondary data collection technique was utilized and conducted through a search of articles published between 2005 and 2014 in PubMed and Google scholar databases. The criteria for selecting publications for inclusion in the study were as follows:

1. Articles published between 2005 and 2014
2. An obesity related intervention
3. Involving children between 4 to 6 years of age
4. Implementation of the intervention in a community, school and home setting
5. A content analysis was then conducted based on the special topics : Childhood obesity and motor skills

A. Anthropometric assessment

Participants height were measured in centimeter (cm) using a portable stadiometer. Participants were required to remove their shoes and stand up straight under the portable stadiometer. Reading was recorded to the nearest 0.1 cm. weight was measured in

kilogram (kg) using a digital floor scale. During the measurement, participants wore light clothing. Upon completion of height and weight measurement, body mass index (BMI) was calculated manually using the Kg/m^2 formula.⁷ Children with a BMI < 5th percentile were classified as underweight, $\geq 5^{\text{th}}$ to 85th percentile as normal, $\geq 85^{\text{th}}$ to <95th percentile as overweight and > 95th to 97th percentile as obese.

B. Body composition

Body fat percentage of each participant were measured by taking triceps and calf skinfold thickness as it is a standard index of body fat. The measurement was taken on the right side of the body through use of Harpenden calipers. The same investigator, trained in skinfold measurement, measured each site twice and recorded it to the nearest 0.1mm. The final value was derived from average from two trials. Body fat percentage of each participant was calculated using the following specific gender equation.⁸ Body fat % = 0.735 (triceps + calf) + 1.0

C. Motor skills proficiency

Agility was chosen as a measure of motor skills and was assessed by the time needed to complete an obstacle course. This test was described by Vogt and Kunz for 3 to 6 year old children. It includes running 1m from a marking cone to a transversally positioned bench, jumping over the bench (36cm high, 28cm wide), crawling under the bench and running back to the marking cone three times in a row as fast as possible. Time was measured in seconds. Each child had two attempts and the faster trial was used for further data analysis.

RESULTS AND DISCUSSIONS

Bonvin et al, 2012⁹ reported as there were no significant weight status or gender related differences in global motor skills. However, in accordance to data in older children, child care based physical activity was higher in boys compared to girls. so it's important to consider when establishing physical activity recommendations or targeting health promotion interventions in young children. Yusof et al., 2013¹⁰ reported as, lack of motor skills proficiency tends to reduce children's competency and confidence level to participate in physical activity. As a consequence of less participation in physical activity, children will turn to be overweight and obese. This study aims to compare motor skill proficiency of underweight, normal-weight,

overweight and obese young boys as well as to determine the relationship between motor skills proficiency and body composition. 112 boys aged between 8 to 10 years old participated in this study. Result indicated that underweight and normal children were superior in motor skills proficiency compared to overweight and obese children ($p < 0.05$). Tiffany 2012¹¹ reported as, early life physical activity may help prevent obesity but is difficult to measure. The purpose of this study was to examine associations of age of achievement of gross motor milestones in infancy with adiposity at age 3 years. Hardy et al., 2012¹² reported as, Low competency in Functional motor skill is strongly associated with lower cardiorespiratory fitness and physical activity levels in children and adolescents. Riethmuller et al., 2009¹³ reported as, this review highlights the limited quantity and quality of interventions to improve motor development in young children. The following recommendations remade:

- 1) Both teachers and researchers should be involved in the implementation of an intervention;
- 2) Parental involvement is critical to ensuring transfer of knowledge from the intervention setting to the home environment

Slining et al., 2009¹⁴ reported as, Motor delay was 1.80 times as likely in overweight compared with non-overweight infants (95% CI:1.09, 2.97), and 2.32 times as likely in infants with high subcutaneous fat compared with lower subcutaneous fat (95% CI:1.26, 4.29). High subcutaneous fat was also associated with delay in subsequent motor development (OR=2.27, 95% CI: 1.08, 4.76). Paediatric overweight and high

subcutaneous fat are associated with delayed infant motor development. Castetbon and Andreyeva 2012¹⁵ reported as, the relationship between motor skills and obesity varied across types of skills. For hopping, obese boys and girls had significantly lower scores, 20% lower in obese pre-schoolers and 10% lower in obese kindergarteners than normal weight counterparts, $p < 0.01$. Obese girls could jump 1.6-1.7 inches shorter than normal weight peers ($p < 0.01$). Other gross motor skills and fine motor skills of young children were not consistently related to BMI z-scores and obesity. Motor skills are adversely associated with childhood obesity only for skills most directly related to body weight.

There is no significant association between obesity and fine motor skills at 4 to 6 years of age is consistent with previous research looking at fine motor skills.¹⁶ One study that examined the link between specifically fine motor skills and obesity found a significant association in 9-13 years old children but not in 5-9 years old.¹⁷ The mechanisms by which fine motor skills decrease with increasing BMI in children when they become older need better understanding.

The association between gross motor skills and body mass status of 4 year old and 5-6 year old children varied by types of skills, with some differences observed across gender and age groups.¹⁸⁻²⁰ Such loco motor competencies are likely to be directly related to the excess weight and impaired musculoskeletal functions of obese children.²¹ Schools should identify physical activities adapted to children's respiratory fitness and body mass status to prevent injury²² (Table-1)

Table-1: Summary of various intervention programs in obese children

AUTHOR	COUNTRY	INTERVENTION	DURATION	STUDY FINDINGS
Joosse et al.,2008 ²³	United states of America	Health educational sessions. Create nutrition plan. Increase physical activities Behavioral lessons: eating disordered, self-care and self-esteem.	12 weeks session (3 times per year)	59% of the children increased their physical activity 32% reduced their sedentary activity, 81% improved and 13% maintained their BMI 74% of the children showed decreased total body circumferences.
Eisenmann et al.,2008 ²⁴	United states of America	Physical activities session. Public education/training workshops for parents, teachers, health care providers, religious leaders and business leaders in the community at large.	8 months.	Enhance children attribute such as knowledge about physical activity and food selections.
Salmon et al.,2008 ²⁵	Australia	Decrease sedentary behaviour. Increasing physical activity	March to November 2002	Significant decrease in BMI among those in the combined BM/FMS group compared with the control group.

Participation of obese children in sports that involve such skills should be encouraged in order to prevent obesity associated differences in gross motor skills in later childhood, as well as for social interactions^{26,27} and self-esteem development.

LIMITATIONS

There are a number of limitations to this study. First sometimes (n=14) focused on childhood obesity in general and were excluded as a result. Second, some interventions were published in other languages and were not able to be reviewed. Third, only articles published in two databases (PubMed and Google scholar) were included. While these databases are reasonably broad, they do not include all the health literature about childhood obesity prevention around the world.

RECOMMENDATIONS

A realistic approach to the prevention of obesity would be to have schools^{28,29} families and communities provide an atmosphere that encourages a physically active existence in combination with sound nutritional practices. In particular, further research is needed to determine habitual physical activity patterns of children of different ethnic and cultural groups, as well as to find culturally appropriate ways to educate and

motivate children to adopt regular physical activity patterns.

CONCLUSION

Overall findings from the present review showed that normal children with physical exercise are more superior in motor skills compared to other peers. Results of the previous studies indicated that normal children's are more efficient in bilateral coordination in greater balancing, efficient upper limb coordination and greater strength^{30,31} when compared to overweight and obese children. Also indicated that there were no gender differences in overall motor skills. Further research is required to explore whether this assumption is correct and its mechanism.

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