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The impact of regular exercise on overweight metabolic syndrome in school-aged children: A literature review

Alice

Student, Galgotias University
Email: dakshalice21@gmail.com

Megha Yadav

Associate professor, Galgotias University
Email: megha.yadav@galgotiasuniversity.com

Rituraj Verma

Professor, Galgotias University
Email: rituraj.verma@galgotiasuniversity.edu.in

Jyoti Sharma

Associate professor, Galgotias University

Yamini Sharma

Associate professor, Galgotias University

Abstract--To review studies that can examine whether there is any effect of physical activity on obesity. Obesity is defined as an energy deficit caused by lifestyle behaviour such as poor food habits & insufficient physical activity time, both of which are significantly linked to obesity development. Journal articles published between 2011-2021 were secured by searching computerized bibliographical databases. High evidence studies such as systemic reviews and cross-sectional studies were included. A total of 30 studies were selected. After analysing the studies, it was seen that: Physical activity has been shown to reduce obesity in children. Increased physical activity (reduced inactive behaviour) in combination with healthy eating appears to be more beneficial in lowering obesity than either a good diet or increased PA alone.

Keywords---Paediatric Obesity (OB), Overweight (OW), Physical activity (PA), sedentary lifestyle.

Introduction

Around 2.1 billion persons were classed as obese or overweight in 2013, characterized as having a BMI of greater than 25 kg/m². Obesity has now become a severe and inescapable worry for people of all generations (Mangalam et al., 2021). Obesity rates have risen in more than 70 nations in the previous a few of decades, with the pace of growth in children being greater than in adults regardless of sociodemographic classification (Ronald J. et al, 2021). Obesity is strongly linked to sedentary behaviors including increasing video games, TV viewing, and every time spent in front of the computer. (Ronald J. et al, 2021). Increased childhood obesity is linked to changes in lifestyle patterns, such as reduced energy expenditure and increased calorie intake, which entail an interplay of genetic and environmental factors. Obesity in childhood aged 6 to 11 years can be reduced with a combination of physical activity and dietary programs. Interdisciplinary treatments were shown to be more successful than single-intervention techniques by researchers (Tal Aferman-Itzhak et al., 2018).

Overweight and obese adolescents and children are becoming more common all over the world, posing a global public health threat (Ng 2014; WHO 2015). Obesity and overweight in children in elementary school are substantial risk factors for a variety of health issues, such as slew of cardiometabolic risk like hypertension, elevated blood cholesterol concentrations, and insulin resistance (J W. et al, 2015).

Obesity is a severe and long-term issue in our culture. Obesity in children is caused by a build-up of extra fat, which can put people at risk for both long- and short-term health problems. Musculoskeletal complaints, cardiovascular aspects such as high blood pressure, stroke, heart disease, diabetes, hyperlipidemia, and Motor and developmental deficits, as well as obesity-related comorbidities such liver disease, sleep apnea, asthma, and type 2 diabetes, can emerge even in very young children. Obesity can also harm psychological well-being, with obese young people reporting reduced quality of life and lower self-esteem, as well as stigmatization. Increased adiposity is a key factor in the growing prevalence of coronary heart disease and adult diabetes in all populations, including low- and middle-income nations like India. In urban India, both diseases have reached epidemic proportions (Sheila Bhave et al, 2017). Obesity in children is caused by a shift in their lifestyle, which is marked by a significant reduction in their habitual physical activity. One of the main reasons of childhood obesity is a lack of physical activity, which is linked to a range of dangerous illnesses (Jana Pyšná et al, 2020).

Obesity is the most common type of obesity in our community, and it is produced by a discrepancy between the amount of energy consumed and the amount of energy expended. If the child is influenced from an early age (e.g., smoking or maternal obesity, fetal weight rise, pregnancy course, etc.), the result is generally unfavourable programming of the organism. At an early age, there is an excess of adipose tissue deposition is caused by an unfavourably elevated calorie intake or an unsuitable diet. As a result, children engage in less spontaneous physical exercise and have poorer levels of physical fitness and motor development. Many dangerous diseases are linked to or can develop as a result of being overweight or

obese. Cardiovascular, Metabolic, pulmonary, gastrointestinal, oncological, orthopaedic, and psychological issues, and also endocrine disorders, are among them (Iana pysna et al, 2020).

Physical activity can be defined as "Any physiological activity produced by muscular contraction which raises energy consumption just above basal metabolic rate, as determined by frequency, duration, intensity, modality, and context of practice," according to the definition." (Justyna Wyszyn´ska et al., 2020).

Physical exercise and activity were recommended as an effective therapy for preventing obesity in adolescents and children, as well as improving obesity-related risk factors. Lower levels of physical activity determined the presence of cardiac autonomic dysfunction (Anand et al 2019). There is a 10% reduction in the chance of acquiring obesity for each and every hour of moderate-intensity activity. Any skeletal muscle activity that causes energy expenditure is referred to as PA. A number of reviews are there which appreciate the positive effect of physical training (Nazia et al 2021). Physical activity can be defined as sports, occupational, home conditioning, or other activities in everyday life. Exercise is a systematic, planned, and repetitive physical activity that has a definite end or intermediary objective in mind, such as improving or maintaining physical fitness. The term "physical fitness" refers to a set of health and skill-related characteristics. Sports, Games, transportation, recreation, housework, planned exercise, or physical education are all examples of PA for adolescents and children in the context of, family, community activities and school (Pinto RM et al, 2018).

To confront pediatric obesity and its associated health risks and co-morbidity, exercise strategies such as aerobic exercise (AE) such as jumping rope, cycling, or running, resistance training (RT) such as cable machines, resistance bands or free weights, and combined aerobic and resistance exercise (CRAE) such as free weights and running are used (Ronald J. et al, 2021).

Physical activity (PA) is among the most efficient approaches to improve physical fitness and avoid cardiovascular and mental disorders. Regular physical activity lowers the risk factors for a variety of diseases, including high blood pressure, diabetes, and obesity. Inactivity can lead to obesity and a lack of cardiovascular fitness in youngsters, as well as an increased risk of cholesterol and high blood pressure. Physical education curricula, active commuting to school, classroom activity breaks, modified playgrounds, and multi-component methods are all examples of school-based PA treatments (Hidayet Suha Yuksel et al,2020).

Physical activity (PA) has a long list of health benefits, including improved body composition and the avoidance of overweight and obesity, as well as better skeletal, metabolic, and cardiovascular health. Numerous psychological advantages, such as a reduction in the symptoms of sadness, tension, and anxiety, as well as boosts in self-confidence and self-esteem, are included in the benefits. The benefits of regular physical activity are significant at any age, but they are especially crucial during the formative years for healthy growth and

development, optimizing cardiometabolic function, and preventing chronic disease (Andrew P Hills, et al, 2014).

Obesity prevention in children has been related to regular physical activity; however, there's also evidence that it might aid with cognitive growth. Because it will be offered to all teachers and children get the chance to incorporate it into the broader teaching process, physical education (PE) in schools is an effective vehicle for promoting physical activity in children (Telford et al.,2012). The goal of this article is to examine the existing research on the effects of physical exercise on childhood obesity.

Materials and Methods

This is a literature review study, and we used an article that was published in PubMed and Google Scholar. In total, 30 papers were collected and included in the study. To find publications on the physical activity impact on childhood obesity. The following keywords were used to search the Medline database for this study: obesity, physical activity, connection, and pediatric obesity. Articles were chosen from the years 2011 to 2021. The abstracts of the publications were chosen, and their reference links were also checked for articles that met our inclusion criteria, and a few of them were taken into account in our study.

Analysis of the articles reviewed

Characteristics of the included studies

AUTHORS	OBJECTIVE	METHODS	RESULT
1) Tal Aperman-Itzha et al, 2018	The goal of this study was to promote a healthy lifestyle and obesity prevention among middle-grade children through a school-based intervention	During the 2011–2012 school year, 396 sixth and fifth grades children from two seculars and two religious schools took part in a nonrandomized controlled trial. A comprehensive educational program focused on eating habits and physical exercise was offered to the intervention group.	Obesity and overweight were considerably reduced in the intervention group. Religious kids was twice as likely to be obese or overweight. Children's health knowledge and weight improved as a result of health education in the sixth and fifth grades, but not their healthy behaviour.
2) Xiao-Hui Li et al, 2014	The goal of this study was to study the Efficacy of school-based PA intervention in school children on Overweight.	At the baseline survey, 921 youngsters aged 7 to 15 years were enlisted. Over the course of 12 weeks, Extracurricular physical activities, enhanced physical education for obese/overweight kids, physical activities at home, and health education lectures for parents and students were all part of the intervention group's (n = 388) multi-component physical activity intervention. The children in the control group (n = 533) went about their daily routines as normal.	The results of the study are the BMI decline in the intervention group was statistically varied from the control groups. The intervention group had substantial effects in subscapular, triceps, fasting glucose, and abdominal skinfold thickness (all P< 0.05). Skinfold thickness, fasting glucose, BMI, and MVPA duration all improved when a multi-component PA treatment was adopted in schools.
3) M. K. Bean et al, 2014	Adherence to childhood obesity therapy increases with motivational interviewing focusing on physical exercise and food.	The participants in this study were split into 2 groups: control and MI. At weeks 1 to 10, MI group got MI sessions; the control group watched videos about health education. T.E.E.N.S. was continued by all participants (behavioural and dietetic support visits	MI group had better three-month adherence, as well as better behavioural and dietician support visits, than controls. They also had better 6-month adherence and behavioural support visits. MI Values is the first study to look at

		every two weeks; supervised physical exercise three times each week). The tests were done three times: once at the beginning, three months later, and again six months later.	how MI affects treatment adherence in obese people.
4) Erik Sigmund et al, 2013	The purpose of this study was to see if the advantages of a 2-year longitudinal non-randomized school-based physical activity (PA) prevention programs for reducing overweight were still observable two years after it controlled treatment ended.	The participants in the research were 92 boys and 84 girls aged 10–12 years who had taken part in the PA treatment as 6 to 9 year-olds in 2006–2008 and were split into 2 groups: intervention (I) (45 B and 43 G) and control (C) (47 B and 41 G). Two years after that the controlled therapy ended, then evaluate the incidence of overweight in a follow-up measurement.	Two years after that the controlled PA therapy ended, the treatment children were less likely than the control kids to be obese or overweight. Physical exercise in school on a daily basis can lower obesity/overweight rates, according to this study.
5) Erik Sigmund et al, 2012	This study looked at whether increasing regular exercise (PA) in the classroom results in higher daily PA and lower overweight/obesity levels in children aged 6 to 9.	From the first to third elementary grades, the PA of 92 boys and 84 girls was assessed five times objectively (for seven consecutive days) using the Caltrac accelerometer and Yamax pedometer (step counts). Four schools (2 intervention, 2 control) were chosen to participate in the study, including control pupils (47 boys, 41 girls) and intervention (43 females, 45 boys).	During schooldays, intervention children experienced a substantially greater amount of school-based PA than control. Increased PA intervention in schools kids contributed to their reaching >10.5 Kcal/Kg per school day and >10,500 steps throughout the course of the study's two years, halting the drop in PA rates that would be thought to just be related to children's age.
6) David R. Lubans et al, 2011	The purpose of this study was to see if the Physical Activity Leaders (PALs) programme was effective and feasible. PALs is a low-active teenage boy weight management programme for impoverished schools.	For the 6-month trial period, four poor secondary schools were randomly assigned to treatment groups. 100 teenage boys took part in the study. Waist circumference, Body fat (bioelectrical impedance analysis), muscular fitness (7-stage sit-up test, 90° push-up test, and leg dynamometer), physical activity (5-days of pedometry), and selected dietary behaviors were the key outcomes.	The study concluded that the PALs program was a viable and effective way to help adolescent boys from low-income secondary schools lose weight in a healthy way.
7) David Thivel et al, 2011	The goal of this study was to see how a 6-month physical activity levels affected body weight and fitness in elementary school students.	A total of 457 children aged 6 to 10 years old were randomly allocated to two groups: observation (228 children) or intervention (229 children). Obesity was determined using BMI reference curves created in France based on the participant's weight and height. The total of fat-free mass and four skinfolds were calculated. Ground tests were used to determine anaerobically (cycling peak power) and aerobically (20-meter shuttle run) fitness before and after a 6-month intervention.	Although a 6-month physical activity intervention at school did not result in favorable anthropometric changes in children, it appears to be advantageous in terms of anaerobic and aerobic fitness. Every week, children should engage in two physical activity sessions in addition to physical education classes, yield good results in the reduction of child obesity in primary students.
8) Selda Bulbul 2020	Management of obesity in children with exercise	This study focuses on the basics of exercise therapy, which is beneficial to both obese and healthy children.	Nutritional control, increased daily physical exercise, and psychological support are all part of the treatment. Diet alone reduces fat and non-fat body mass significantly. Adding exercise to a weight-reduction programme, on the other hand, enhances weight loss by retaining non-fat body mass.
9) Juozas	The goal was to see how	An investigation of 532 Lithuanian	20.1 percent of the kids were

Raistenskis et al, 2015	normal-weight, overweight, and obese kids differed in terms of physical fitness and activity.	children's anthropometric data was conducted. The researchers took measurements of their height, waist and hip circumferences, weight, and skinfold thickness. Waist-to-hip ratio, BMI, and Body fat percentage all were measured. To assess fitness and activity, and 6-minute walk test (6MWT) and Youth Physical Activity Questionnaire were used. To determine the children's aerobic capacity, the maximum oxygen consumption was computed.	overweight, according to the findings. During a 6-minute test, they walked 50.9 meters less and engaged in 22.4 minutes less MVPA per day than normal-weight. Children who were overweight or obese were had less physical fitness and less active than children who were of normal weight.
10) Richard D et al, 2012	They wanted to see if specialist-taught physical education (PE) aided intellectual growth and obesity prevention in primary school students.	In a two-year longitudinal study in Australia, 620 girls and boys in grade 3 were recruited and given 150 minutes of physical exercise each week. The first group (n = 312: specialist-taught) received 90 minutes of physical exercise each week from visiting experts, whereas the second group (n = 308: common-practice) received all of their physical activity from generalist classroom instructors. Dual-emission x-ray absorptiometry, as well as numeracy, writing, and reading skills were used to assess the amount of body fat (by government tests).	Specialist-taught PE was linked to a lower increase in age-related total body weight as compared to general-practice PE. Specialist-taught PE was also linked to higher gains in writing (P = .13) and in numeracy (P = .03) scores.
11) Sheila Bhavne et al, 2017	The efficacy of a five-year intervention program at the school in Indian children to minimize fat accumulation and lifestyle and promote fitness.	Children in the Pune intervention school who were 12-15 years old at the start of the trial were divided into two control groups: children of the same age attending a similar school in Nasik and children in the Pune intervention. A five-year multi-intervention programme that focuses on three domains: food, physical activity (including increased intra- and extracurricular physical activity sessions), and general health, with physical activity becoming a "score" subject, daily yoga-based breathing exercises, nutrition education, healthier school meals, removal of fast-food hawkers from school environs, and nutrition and health education for families, teachers, and pupils.	After the program, intervention children were fitter than controls in long jump running, sit-up, and push-up tests (p<0.05). They spent less time sitting, more time actively playing, and more on fruit (p<0.05). The intervention had no effect on BMI or overweight prevalence, although it did reduce waist circumference (p=0.004) when compared to the Pune controls. These changes improved physical health and had no effect on the children's BMI prevalence.
12. Johannes W de Greeff et al, 2015	The goal of this study was to see how physically active academic lectures affected children's physical fitness and body mass index (BMI)	Children in 2 nd or 3 rd grade were allocated at random to either a 22-week intervention program or a control group from 12 primary schools (8.1 ± 0.7 years; N=376). Prior to and following the intervention, physical fitness was assessed using five items from the Eurofit test battery, which assesses muscular fitness and cardiovascular as well as BMI.	A significant interaction impact among grade and condition (control vs intervention) identified. In 3 rd grade students, the intervention group BMI did not change much throughout the intervention period, but the control group BMI increased markedly. The current physically active academic classes improved children's BMI but had no influence on cardiovascular and muscular fitness.
13) Dalibor Pastucha et al, 2015	The efficacy of PA in the treatment of childhood obesity	The researchers wanted to see if there were any changes in anthropometric characteristics, physical activity (PA), and maximum oxygen uptake	Only the boys' VO ₂ max and waist circumference showed statistically significant changes, whereas only the girls' VO ₂ max showed

		(VO ₂ max), between groups, of 128 girls and 146 boys in this study. Changes in PA were compared to changes in body fat, VO ₂ max, weight, hip & waist circumference.	statistically significant changes.
14) Nanette Erkelenz et al, 2014	The goal of this study is to see if there's a link between children's BMI percentiles and their parents' physical activity levels (PA), which ranges from moderate to vigorous (MVPA), and organized sports involvement.	In 1615, German children's height and weight were calculated with respect to BMIPCT. Using self-reported height and weight, the parents' BMI was calculated. A parental questionnaire was used to examine children's sports involvement & MVPA, as well as parental PA.	Overweight or obese children are more likely to be born to sedentary parents. When both parents were physically active, children's BMI percentiles were lower than when only had one physically active parent or both parents were inactive. There was a link between the number of minutes boys and girls spent participating in organized sports each week and parental physical activity.
15) Andrew P Hills et al, 2011	Obesity in childhood and physical activity	Puberty and the ensuing adolescent years are recognized as particularly susceptible periods for the development of obesity caused by sexual maturation and, in many cases, a concomitant decline in physical activity.	More sedentary interests have substituted active behaviours, resulting in lower energy expenditure from physical exercise. Children are more likely to have less healthy lives than their parents if they don't participate in proper physical activity. Because of the significant likelihood of overweight teenagers becoming obese adults, Getting kids and teenagers involved in sports and physical exercise is a critical objective in the fight against obesity.
16) George A. Kelley et al, 2013	Undergo a comprehensive evaluation of past meta-analyses on the impact of the activity on the management of obese and overweight adults and children.	Previous meta-analyses of RCTs that evaluated adiposity in obese overweight and adolescents and children were included after exploring internet sources and cross-referencing from retrieved papers.	obese & overweight adolescents and children, exercise is effective in lowering % body fat.
17) Samantha K. Stephens et al, 2014	The goal of this research is to give a broad review of therapies for preventing or reducing obesity or overweight, as well as physical activity and improving nutrition.	In whatever environment or age group, the researchers conducted a meta-analysis and/or systematic review of these interventions. Narrative systematic reviews were considered for intervention categories with minimal meta-analyses. The criteria for inclusion were met by 23 systematic reviews & 60 meta-analyses	Multi-component treatments and nutritional interventions targeting obesity and overweight proved to have the most impact when compared to the workplace, technology, or internet-based therapies. For select population sub-groups, pharmaceutical and surgical therapies have positive outcomes (i.e., morbidly obese).
18) Jill L Colquitt et al, 2016	The goal of this study was to see how behavioural treatments, physical activity, and dietary affected the therapy of overweight or obesity in pre-schoolers children aged 6 years and up.	They conducted a comprehensive literature search using the databases Cochrane Library, CINAHL, MEDLINE, PsycINFO, EMBASE, and LILACS. For all databases, the most recent search was in March 2015. For the treatment of obesity in preschool children aged 0 to 6 years, they chose RCTs of behavioral interventions, physical activity, and diet.	Multicomponent treatments appear to be a beneficial treatment option for overweight or obese preschooler children between the ages of six.
19) Jana Pyšná et al, 2020	Impacts of physical activity on overweight among second-year elementary school students in	The figures were compiled using BMI-for-age and questions from the NAS 2001 questionnaire (national anthropological survey). The NAS 2001	There were discrepancies among the study groups, with those with a higher BMI having the lowest levels of physical activity. More

	northwest Bohemia	is a questionnaire for children that measures their engagement in routine activities and other physical activities, as well as their drinking, eating, and body habitus care habits.	than two-thirds of the survey participants said they ride a bicycle for transportation and to stay active in their spare time. The findings of the study back up the current obesity epidemic and recommend that adequate physical exercise should be included into children's everyday life, both at schools and outside of it.
20) Ronald J et al, 2021	Exercise's effects on childhood obesity	Altered energy metabolism hormones and levels of hunger, glucose intolerance, arterial stiffness, and vascular endothelial malfunction are some of the juvenile obesity-related cardiovascular events risk factors discussed in this study. Furthermore, early intervention to treat paediatric obesity is crucial since obesity has been shown to follow children and adolescents into adulthood, putting them at a higher risk of early mortality.	This review summarises the evidence that exercise program is an effective therapeutic strategy for lowering cardiovascular risk, and that the suitable exercise program for paediatric obesity should include both aerobic & muscle strengthening aspects, with a focus on fat mass loss and long-term compliance.
21) Hidayet Suha Yuksel et al,2020	The goal of this study is to look at the effectiveness of school-based strategies controlling for obesity, as well as encouraging physical fitness and activity	Three distinct datasets comprised intervention in elementary and secondary schools, evaluating physical exercise, physical fitness, or at least one obesity characteristic (2010-2019). Out of 395 studies that were potentially linked, 19 satisfied the qualifying requirements.	School-based interventions can have a major influence on obesity prevention including physical fitness and activity promotion because they more focus on the quality, importance, content, and length of physical exercise.
22) Mia Pradinuk et al, 2011	What regular exercise suggestions should I provide overweight children's parents, according to this study?	Physicians should counsel children and teenagers to spend at least 30 minutes per day on physical activity, including at least 10 minutes engaging intense exercises. Set a daily target of at least 90 minutes of overall physical activity.	The quantity of PA those adolescents and children participate in is determined by a number of complicated, interconnected factors. The link between physical inactivity and child obesity necessitates a diverse and integrated strategy.
23) Jose Manuel et al,2020	The goal of this meta-analysis has been to assess the impact of current physical activity treatments on moderate and vigorous physical activity (MVPA) time and body mass index (BMI) Z-score, as evaluated by accelerometry, in obese children.	From January 1991 to August 2018, randomized controlled trials (RCTs) focused on physical activity interventions for obese children (ranged in age from 6 to 12) have been included in the study. Only 10 RCTs out of a total of 229 studies judged possibly suitable met the inclusion criteria.	They came to the conclusion that programs containing a physical activity component in obese schoolchildren are successful at lowering BMI and increasing the amount of time spent doing physical activity. As a result, physical activity-based therapies should be regarded one of the primary techniques for addressing paediatric obesity.
24) Julie Nantel et al, 2011	The goal of this evaluation of the research is to give insight into the administration of physical exercise. The effects of OB and OW on biomechanical and physiological responses connected with the musculoskeletal system and exercise regularly are among the topics explored.	By integrating ideas, the objective of the study review is to give insight into the prescribing of PA for the population. The consequences of being overweight or obese on physiological and biomechanical reactions to everyday physical activity, as well as the musculoskeletal system, are among the issues investigated. Obesity's impacts on youth's locomotor (walking, running, and cycling) and postural (standing) activities are highlighted.	Physical activity is indicated to help people lose weight, avoid regaining weight, and minimise their chance of having metabolic and orthopaedic disorders.
25)Noemi Serra-	The goal of this study was	The 8-month research involved 113	The study found that Both groups

Paya et al,2015	to see how successful the Nereu Program was in improving physical activity, anthropometric measurements, nutritional consumption, and Inactive behavior.	overweight or obese children between the ages of 6 and 12. Eligible individuals was allocated randomly to either routine paediatrician advice on healthy food and physical exercise or an intensive, a multi-component family-based behavioural intervention (Nereu Program group) prior to recruitment. Pre- and post-intervention anthropometric characteristics, Physical activity, sedentary behaviour, and food consumption was all monitored objectively.	had similar reductions in body mass index at the conclusion of the research. Nereu Program participants had higher moderate-intensity physical activity and regular fruit serving size, as well as lower daily soft drink intake, as compared to the counseling group. In comparison to the counselling group, participants in the Nereu Program improved their food habits and physical activity at the end of the 8-month intervention.
26) Justyna Wyszynska et al, 2020	This research discusses the impact of physical activity on the obesity prevention and offers age-appropriate PA advice as well as suggestions for guardians, parents, and, school-based therapies.	From 2018 to August 2020, a searched PubMed/MEDLINE, science direct, Cochrane Library, and EBSCO databases for randomized clinical trials, English language meta-analyses, observational studies systematic reviews.	Physical activity's involvement in weight loss prevention, as well as age-appropriate PA and school-based intervention suggestions for parents and guardians.
27) Dan Nemet et al, 2017	Obesity in children, physical exercise, and activity	Researchers used search engine records for 32,000 Microsoft Band users over the course of three months and a mix of signals from large-scale corpora of wearable sensor data to investigate the effects of Pokémon Go on PA. Pokémon Go participants are identified through their physical activity is tracked using accelerometers and search engine queries	Pokémon Go causes considerable elevated in PA over the course of 30 days, with especially engaged participants, a more than 25% increase over their prior activity level, raising their activity by 1473 steps per day on average (p<.001).
28) Pinto RM at al, 2018	PA has been shown in this study to promote favourable adaptations in children with obesity and to assist in its treatment and prevention.	PA is the only exercise that can be totally controlled by the individual; hence it plays a significant role in regulating energy expenditure. By fostering favourable adaptations, PA can prevent a lot and management of paediatric obesity.	In obese children, PA improves body composition (reducing fat mass & increasing lean mass), cardiorespiratory fitness, proprioception strength gain, increased caloric expenditure, increased tolerance to glucose, increased caloric metabolic rate, increased insulin sensitivity, reduced inflammatory status & improved lipid metabolism.
29) Phillipp Schwarfischer et al, 2017	The purpose of this study is to look at children's adherence to physical activity guidelines (PAGs) and the relationship between objectively assessed BMI and PA.	The youngsters that took part in the study were 11 years old (n = 419). Using a SenseWear™ armband, each child's PA was measured for at least two days. The BMI was computed using the height and weight of the youngsters. Receiver Operator Characteristics (ROC) analysis was used to identify the thresholds of minday1 in PA required to distinguish between normal and excess weight (overweight/obesity).	PAGs are reached by two-thirds of children and appear to be effective in preventing childhood obesity. An official recommendation of 15–20 minutes of vigorous physical activity each day, as well as a reduction in inactive time, could aid in the fight against teenage obesity and thus be of public health importance.
30) Dylan P Cliff et al, 2011	The goal of this study was to see how overweight children responded to the Hunter Illawarra Kids Challenge Using Parent Support physical activity programme.	The researchers performed a randomised controlled experiment with three intervention arms: a child-centered physical activity skill development programme (Activity), a parent-centered dietary management programme (DIET), or both (PA+DIET). 165 prepubertal children aged 5.5–9 years were examined for movement skill	The exercise and activity + diet regimens were both beneficial in improving the movement skill competency of obese children. All of the programmes were successful in reducing the amount of time spent on screens.

		competency, accelerometer-measured physical activity, perceived athletic ability, and parent-reported screen usage at baseline, 6 months, and 12 months.	
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Discussion

The goal of this research was to examine if physical activity had an effect on obesity in school-aged children. We used a variety of RCTs, cross-sectional studies, and systematic reviews for this investigation, and after analysing these papers, we discovered that physical activity does have an influence on obesity. Insufficient physical activity levels are related to a variety of unfavourable health markers, such as a rise in body fat/obesity, metabolic and cardiovascular disorders, and complaints of musculoskeletal problems, according to studies that support the link between physical activity and obesity. Obesity puts the body at a higher risk of cardiovascular and musculoskeletal disorders for a variety of reasons.

Multidisciplinary interventions, rather than focusing on a single intervention, were found to be more beneficial by researchers. PA, behavioural counselling, parent modelling, and good eating habits should all be included in interventions that engage both the home and the school. Children in the sixth and fifth grades are entering puberty, just before becoming teens, and parental control over their diet and activity begins to wane. Obesity in childhood aged 6-11 years old can be reduced by combinations of dietary and physical activity programs (Tal et al,2018).

In the treatment of pediatric obesity, a dietary intervention combined with a physical activity intervention should be explored. Despite the fact that the majority of trials only contained general dietary advice rather than specific controlled treatments, the majority of them claimed good obesity management results. During educational sessions, Wafa et al taught parents how to alter their behaviour, whereas Taylor et al provided dietary goals that were assessed using questionnaires that yielded a particular healthy intake pattern score. Cliff and colleagues added a nutritional modification program, which allowed parents to alter their eating patterns and increase the quality of their diet. When compared to PA or interventions with dietary advice, a combo of dietary regimens and physical activity is more effective in reducing adiposity or BMI.

Samantha et al. discovered that multi-component therapies and nutritional interventions designed to target obesity and overweight emerged to get the highest impact in their review, which comprised 23 systemic reviews and 60 meta-analyses. Overall, multi-component therapies were more successful in reducing body weight and BMI in preschool children than the controls.

Obesity is linked to an inactive lifestyle and a lack of activity. The effects of PA in the treatment of juvenile obesity were explored by Dalibor Pastucha et al, who found a substantial variation in the level of Physical activity consumed each week when obese boys and girls were compared. Changes in PA are linked to changes

in body fat, VO₂ max, weight, hip circumference, and waist circumference. Only the boys' VO₂ max and waist circumference showed statistically significant changes, while only the girls' VO₂ max showed statistically significant changes. Because of the benefits of regular exercise for weight loss, physical activity is crucial in the treatment of pediatric obesity.

A systematic review by Hidayet et al the goal of this research is to look into the potential for school-based interventions to promote physical fitness and activity while also preventing obesity metrics (waist circumference, BMI, skinfold), Physical fitness, and physical activity level. Because children spend so much time at school, promoting health in schools will have a significant influence on their health and well-being.

Juozas et al. look at the disparities between PA and PF in children who are obese, overweight, or normal weight. According to the findings, 20.1 percent of the youngsters evaluated were obese or overweight. They walked 50.9 meters less on average during the 6-MWT and conducted 22.4 minutes less moderate-to-vigorous physical activity (MVPA) each day than children of normal body weight. The duration of daily MVPA and the majority of the children's anthropometric measures were associated with PF parameters. Obese & overweight children were shown to be physically inactive and to have inferior physical health than children of normal weight. Interventions to boost physical fitness and activity in overweight and obese children are required. The impact of a good way of living treatment on anthropometry, behaviour, and health education was explored by Tal Apheran et al. School-based healthy living instructional programs are critical for weight control and primary prevention, according to the researchers.

Conclusion

In conclusion, Obesity in children appears to be influenced by physical exercise. PA is a successful method for preventing and treating paediatric obesity. The practice of PA in obese children improves body fat percentage (reduction of fat mass and an increase of lean mass), as well as cardiorespiratory fitness. It is our responsibility to promote and develop PA in infancy and adolescence. As a result, interdisciplinary, family-focused, and community-assisted programs, as well as school-based PA, play a critical role in reducing childhood overweight and obesity.

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