



A STUDY ON THE EFFECT OF PHYSICAL ACTIVITY ON THE BODY COMPOSITION DURING CHILDHOOD

Preventive Medicine

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ABSTRACT

Aim: The aim of the study was to see the effects of physical activity on body composition of ethnic Indians in middle school and high school by using subjective and objective assessment tools. **Objective:** To compare the body composition of children who do physical activity to the group of children who do not engage in regular physical activity. **Results:** 30 middle and high school students from grade VI through XII were studied; among that 56.7% female and 43.3% male children had participated. In that, 16 (53.3%) of the students have good physical activity and 14 (46.7%) had poor physical activity. 9 out of 15 students (60%) in middle school have good physical activity score as compared to the 7 out of 15 (46.7%) students of high school. 56.7% fall under the normal weight category and 6 (20%) were overweight.

KEYWORDS

Childhood obesity, physical activity, malnutrition

INTRODUCTION:

Obesity is a state of being overweight or the abnormal or excessive fat accumulation that could pose serious threat to someone's health. The value of physical activities plays a major role in well being. Every individual wants to have a healthy and fit lifestyle, but it comes with exercise and a good diet. Unfortunately, many people ignore these tasks, which lead to obesity. Obesity is caused by overindulgence of high calorie intake or lower energy expenditure resulting in the body storing excess fat. In developing countries like India around 25% of the childhood population is being diagnosed with both overweight and malnutrition. Apart from the energy imbalance there are other factors that can aggravate obesity one among that is Hormone imbalances. A person's genes can affect hormones that is responsible for maintaining weight by signaling the brain to eat less when the body fat store is too high, growth hormone deficiencies secreted by the pituitary gland which influences a person's height and helps build bone and muscle. Other hormonal factors include thyroid deficiency, which regulates metabolism. As we have reached a generation overtaken by technology, many children and adolescents end up sitting at home all day and eating too much subconsciously. Since they don't end up burning the calories by physical exercises, they become either overweight or obese. As per WHO childhood obesity is one of the most serious public health challenges. Childhood Obesity is very likely to continue into adulthood and affect the quality of life by causing diabetes, hypertension, and dyslipidemia. Children may suffer through depression and isolation as a result of bullying; these can affect child mental health at young age. The future of our world is at risk because of such issues. Therefore, prevention of obesity and its associated diseases is of highest priority.

The treatment of childhood obesity is complex; Diet and physical activities plays major role in management of obesity. Lack of physical activities is the most common cause of obesity. With regard to the diet, children need high nutritional and calorie-controlled food along with exercise, supplements. The need for more extra circular activities in schools, as over 10 percent of the school aged students are estimated to be carrying excess body fat.

AIM AND OBJECTIVE:

To compare the body composition of children who do physical activity to the group of children who do not engage in regular physical activity. Background Research: The management of obesity starts with diagnosis which includes thorough analysis of the child's history including medical conditions, diet recall and evaluation of their body composition. The most commonly used method to measure obesity is BMI - a person's weight (in kilograms) divided by the square of his or her height. People with a BMI of 30 or over are usually considered to be obese while people with a BMI of a 25 or higher are usually considered to be overweight. However, Asians and Indians have lesser lean mass and a higher fat percentage than the western population.

Hence, they are prone to the consequences of obesity earlier than the westerners. Therefore, the WHO and international diabetic federation (IDF) have jointly modified the classification for Asians (Indian) by reducing the range of BMI by 2.5 kg/m². However, the BMI of children and young adults differs from that of adults. Refer to the table 1 for the classification.

Table 1 - Classification Of Obesity In Children According To WHO

Weight Category	Percentile Range
Underweight	Less than 5th percentile
Normal	5th percentile to less than 85th percentile
Overweight	85th percentile to 95th percentile
Obesity	95th percentile or greater

Current Study:

After having researched on the subject of childhood obesity I have realized that there is an urgent need for awareness in the society, especially in schools, to emphasize that children are in need of physical activity in their day to day routine to avoid the consequences of obesity. This gave me the idea to analyze the role of physical activity among children and young adults which can help guiding them towards a better quality of life.

MATERIALS AND METHODS:

The aim of the study was to see the effects of physical activity on body composition of ethnic Indians in middle school and high school by using subjective and objective assessment tools. The above study was conducted in The Pupil School, in Chennai during July 2019.

Methodology:

Subjective assessment is done using 2 sets of standardized questionnaires, physical activity questionnaire - Children (PAQ-C) for middle school and physical activity questionnaire Adolescent (PAQ-A) for high school students (Cruz). Objective assessment was measured using body composition analyzer (BCA). Primary school students were not included in the study as there were no standardized questionnaires available to assess their physical activity due to their varying body compositions.

Subjective Assessment:

The questionnaires are internationally validated and cited in many published articles. PAQ-C and PAQ-A are self administered. Students were asked to fill the forms in their classroom session. The questionnaire is a 7 day recall instruments. PAQ assesses the level of physical activity throughout the week for students. PAQ-C and A provide 10 and 9 multiple choice questions respectively

PAQ scoring:

The activities between 1 and 5 for each item (excluding item 10 in PAQ-C & item 9 in PAQ-A) have been individually scored. The

questionnaires used have been attached in Annex I & II respectively. The analysis of the questionnaire was done in 5 steps. Points were awarded to each.

Item 1 - Mean of all activities ("no" activity being a 1, "7 times or more" being a 5) on the checklist to form a composite score for item 1.

Items 2 to 8 - Mean of the reported value that is checked off for each

item (the lowest activity response being a 1 and the highest activity response being a 5) on the checklist to form a composite score Item 9 (for PAQ-C only) Take the mean of all days of the week ("none" being a 1, "very often" being a 5) to form a composite score for item 9. Calculating the final activity summary score: Once the value is obtained from 1 to 5 for each of the 9 items (items 1 to 9) used in the physical activity composite score. With regards to PAQ-C, the mean of 9 items is taken, which results in the final PAQ-C activity summary score. A score of 1 indicates low physical activity, whereas a score of 5 indicates high physical activity. However, a score of 2.75 is regarded as the cut-off score between poor and good physical activity for PA-C. In case of PAQ-A, the mean of 8 items are taken and a score of 2.73 is regarded as the cut-off score between poor and good physical activity. Item 10 - Can be used to identify students who had unusual activity during the previous week, but this is NOT used as part of the activity score. However, students who scored YES for item 10 were excluded from the study.

Objective Assessment:

An objective assessment through the body composition analysis (BCA) by measuring the Body Mass Index (BMI) using an "in Body composition analyzer" ⁽¹⁵⁾. The BCA analysis chart is shown in Annexure 3. This machine provided us with an automated validated printout listing various parameters required to assess the body health status. The children were asked to step on the machine barefoot and their anthropometry including age, sex, and height were entered in to the analyzer. They were then asked to align their feet with the foot electrodes on the machine, and then hold the handles on the sides by placing their thumbs on the finger electrodes while standing upright and looking forward until the analysis was completed which would take 30 seconds to complete. The machine would then provide us with a printout and soft copy of the BCA of that student. Anonymity of the student's BCA was maintained as well. The students were debriefed about the study and were given an explanation of BCA at the beginning. They were also given an insight into obesity and its consequences.

RESULTS:

30 middle and high school students between the ages of 9 -17 had participated in this study. Out of this, 217 (55.6%) students were from middle school with 89 (41%) boys and 128 (59%) girls, with the mean age of 11.65 ± 0.88. A total of 173 (44.4%) students in this study were from high school with 80 boys (46.2%) and 93 girls (53.8%), with the mean age of 14.2 ± 0.99 (refer to table 2.).

30 middle and high school students from grade VI through XII were studied; among that 56.7% female children and 43.3% male children had participated of these. Grade IX had the highest percentage of students (26.7%) and Grade XI, XII had the lowest number of students (3.3%). Besides this, Grade VI has 13.3% of children, from Grade VII has 20% students were recruited, and Grades VIII and X have nearly 16.7% of children each.

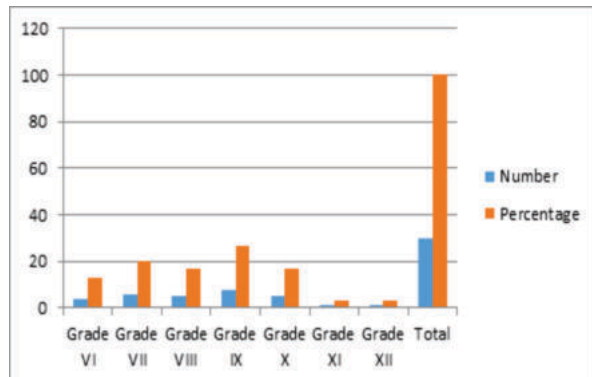


Figure 1. Distribution Of Students As Per Class

Physical Activity:

16 (53.3%) of the students have good physical activity and 14 (46.7%) had poor physical activity. However, more boys had significance over girls in physical activity with 9 out of 13 (69.2%) boys and 7 out of 17 (41.2%) girls. Less number of boys has poor physical activity as well - 4 boys (30.7%) against 10 (58.8%) girls. 9 out of 15 students (60%) in middle school have good physical activity score as compared to the 7 out of 15 (46.7%) students of high school.

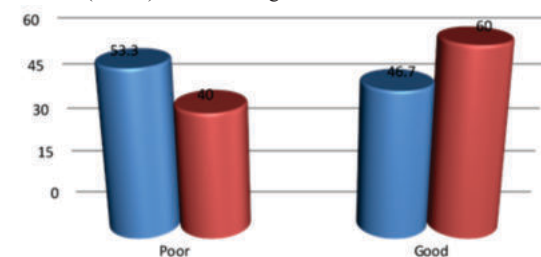


Figure 2: PAQ A And C Results With Regards To Good And Poor Physical Activities.

Body Composition:

A very high percentage of students (56.7%) fall under the normal weight category. However a significant number of students are above normal weight, which, include 6 (20%) overweight students and about 4 (13.3%) obese students. Interestingly, around 10% (3 students) were underweight as well (Refer to table 4 and figure 3). BMI for this study ranges from 15 kg/m² to 29.3 kg/m² with a mean BMI of 20.3 kg/m². There is no association found between age of children and physical activity as well.

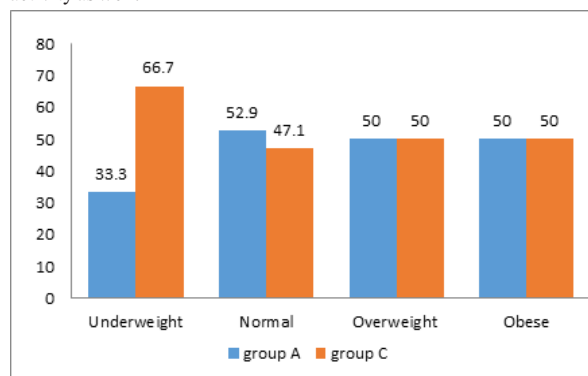


Figure 3: BMI Classification - Weight Categories Per Group (High School-A And Middle School-C)

Physical Activity Vs Body Mass Index: A total of 12 students out of 16 with good physical activity (75%) have a normal body composition, where as only 5 out of 14 students (35.7%) with poor physical activity have normal BMI. There is no significant difference in the BMI with regards to the physical activity, gender and age among students, with 8 out of 15 boys (53.3%) are in normal BMI vs physical activity range as compared to 9 out of 17 girls (52.9%). A high number of students, 57.1% (8 out of 14), with poor physical activity are obese compared to only 35.7% (5 out of 14) with in the normal BMI. Refer to table 5.

Table 5: BMI vs PAQ Results

Physical Activity		BMI Category				Total
		Normal	Obese	Over weight	Under weight	
Group A	Poor Physical activity	3	2	3	0	8
	Good Physical activity	6	0	0	1	7
	Total	9	2	3	1	15
Group C	Poor Physical activity	2	1	2	1	6
	Good Physical activity	6	1	1	1	9
	Total	8	2	3	2	15
Total	Poor Physical activity	5	3	5	1	14

	Good Physical activity	12	1	1	2	16
	Total	17	4	6	3	30

DISCUSSION:

Health and body composition of children and adolescents of this generation is one of the most widely studied topics by scientists. There has been a decrease in the quality of life and increase in the prevalence of diseases. Cunnane SC, et al, in his study has concluded that there is a correlation between elevated cholesterol, hypertension, and coronary heart disease due to the ineffective dietary intake and low exercise level during the critical period of growth during childhood and adolescence. This has been directly correlated to the rapid advancement in technology and internet of things of the present generation. Another meta-analysis by Ana Nikolic (Nikolic) on 21 published articles had demonstrated that physical activity has statistically significant positive effect on body composition of children. The primary objective of this study was aimed at analyzing the effect of physical activity on the body composition of ethnic Indian children. The strength of our study includes children and adolescents with a wide age range, including both genders with comparison of physical activity and body composition through standardized parameters.

Our observation has shown that more students are into physical activity during their middle school (60%) which is much higher than the 46.7% students of high school. Interestingly, more students from middle school engage in good physical activity. More girls indulge in good physical activity (50% - 4 out of 8) at the middle school level than at the high school level (33.3% - 3 out of 9). However, there is no major difference in the physical activity undertaken by boys during middle school (71.4% - 5 out of 7) as compared to those boys in high school (66.7% - 4 out of 6). This result has been also observed in the meta-analysis by Eisenburg LK, et al. Since the PAQs were a subjective analysis filled by the students, there is a possibility of the data being erroneous. However, PAQ questionnaire is a clinically approved survey that has been used in many researches and provides positive results (Alvero-Cruz).

As the age increases, the number of underweight children decreases (66.7% in middle school and 33.3% in high school). However, there is no significant difference in other BMI categories between children and adolescents. Though there is no correlation between age and body composition, the study results has some shown significance between gender. Though there is no significance shown gender wise as 9 out of 17 (52.94%) girls have normal BMI against 8 out of 13 boys (61.5%), there is a strong significance in overweight and obese category where 41.2% (7 out of 17) girls fall under this category against 23.1% (3 out of 13) boys have higher BMI. Our observation is partly contrast to the studies by Sukariyah MD, et al who concluded that boys are more prone for overweight and obesity during adolescence. However there seems to be no difference in gender during the childhood obesity. The same conclusion was observed in Kumaravel V, et al in his meta-analysis. This study suggests a very strong correlation between physical activity and body composition. There is significance between good and poor physical activity for boys and girls. However, the difference is higher for males in comparison to that of females and does not increase the predictable ability of BMI to classify children and adolescents based on age alone. A similar conclusion was arrived at in a study identifying BMI cut-offs using age and pubertal developments done by Taylor RW et al, 2003 (Taylor RW). This explains the insignificance of BMI with regards to adiposity and physical activity in our study and reiterates BMI not being the only reliable predictor of obesity (Vanderwall). There is a predictable trend of increase in the physical activity and body composition during the end of middle school and early high school (Annexure 4), which can be attributed to two factors; namely the pubertal growth spurt and lesser strenuous grades. These two factors could also be a cause for a decrease in physical activity and body composition, during class 12. However, a detailed study would be required to validate the same. Since BMI isn't the only predictor of obesity, it explains why the correlation between BMI and physical activity is stronger. For future experiments I'd like to research and gather data on other predictors of obesity such as percentage body fat, skeletal muscle mass, basal metabolic rate, etc. for more accurate results.

CONCLUSION:

The most significant conclusion derived from this study is that the decrease in the physical activities is strongly associated with rise in

obesity among adolescent children. Physical activity improves body composition during middle and high school with more significant results during the high school period. Body Mass Index along with physical activity scoring is a simple indicator to evaluate the level of health and fitness of the student and should be preferably used in schools on a regular basis to assess the fitness level of the students. There has to be a strong emphasis on physical activity, with the relevant facilities in schools and mandatory sports periods and participation in games. It is currently an immediate need of the hour to educate the student community about the importance of physical activity and healthy lifestyle changes to protect the younger generation from the obesity menace. However, further study is recommended with larger group of students with addition parameters of body composition to arrive at more accurate study of fitness of the children.

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