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Effectiveness of Aerobic Exercise on Obesity among Adolescents: A Study from Western Maharashtra

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ABSTRACT

Introduction: Obesity has become a widespread global epidemic, prompting the World Health Organization to express concern about its increasing prevalence, which poses risks for non-communicable diseases in many nations.

Material and Methods: One group pre-test and post-test experimental research design conducted on Secondary school going students. Ethical clearance was obtained from the ethical committee and a total of nine schools were selected for the study. The sample comprised 127 adolescents, and both the adolescents' assent and their parents' consent were obtained. The respondents were assured that their information would remain anonymous and confidential. The researcher then gathered the data, which included socio-demographic variables from the adolescents, as well as pre-test anthropometric measurements were assessed. Over a period of three months, the adolescents participated in aerobic exercises, which lasted 45 minutes per session, including 15 minutes for warm-up, 30 minutes for exercise, and 15 minutes for cool-down. These sessions were held three times a week. After three months, a post-test was administered to assess obesity.

Results: The present study result shows that pre-test mean of the height, Body Weight, the Body Mass Index, Waist Circumference, and Mid Arm Circumference found significantly difference compare to post-test at the level of $p<0.0001$.

Conclusion: The findings indicate that physical activity can significantly reduce obesity among Secondary School Students

Keywords: *Aerobic Exercise, Obesity and Adolescents*

1. INTRODUCTION

Obesity has become a widespread global epidemic, prompting the World Health Organization to express concern about its increasing prevalence, which poses risks for non-communicable diseases in many nations. The National Health and Nutrition Examination Survey (2011-2014) found that childhood obesity rates have remained around 17% for those aged 2 to 19 over the past decade.[1] Overweight and obesity are prevalent nutritional issues in both developed and developing countries, impacting not only adults but also children and adolescents. The World Health Organization (WHO) defines adolescence as the age range from 10 to 19 years. The primary factors contributing to rising obesity rates include increased consumption of energy-dense foods high in fat, salt, and sugars, as well as reduced physical activity due to changes in transportation and increasing urbanization.[2]

Worldwide, from 1975 to 2016, the prevalence of overweight or obese children and adolescents aged 5 to 19 increased more than four times, growing from 4% to 18%.[3] Globally, around 10% of school-aged children between 5 and 17 years old are classified as obese or overweight.[4] In India, the prevalence of overweight and obesity among adolescents rose from 9.8% in 2006 to 11.7% in 2009.[5]

The exact mechanism of obesity development remains unclear, but it is recognized that obesity arises when energy intake exceeds energy expenditure. This imbalance has various causes, indicating that the rising prevalence of obesity cannot be linked to a single factor.

Adolescents who are overweight or obese face an increased risk of developing several non-communicable diseases, including diabetes and cardiovascular problems. Those who have been obese since childhood or adolescence are 50–100% more likely to experience health issues related to cardiovascular disease, diabetes, cancers, and arthritis.

Environmental factors, lifestyle choices, and mental health play a significant role in the rising prevalence of obesity worldwide.[6] Children in urban areas tend to have higher obesity rates compared to their rural counterparts. The lifestyle changes among urban residents, especially children, may significantly contribute to this disparity in obesity prevalence between urban and rural regions.[7] Insufficient physical activity among children and adolescents is a significant factor contributing to the rising rates of overweight and obesity in this age group.[8] Aerobic exercises, widely acknowledged for enhancing cardiovascular health and overall fitness, provide a promising strategy for promoting healthy body composition and decreasing obesity rates in children. Hence, examining the impact of aerobic exercise on obesity in adolescents is an area of significant interest.

2. MATERIAL AND METHODS

One group pre-test and post-test experimental research design conducted on Secondary school going students. Ethical clearance was obtained from the ethical committee and a total of nine schools were selected for the study. The sample comprised 127 adolescents, and both the adolescents' assent and their parents' consent were obtained. Additionally, permission was granted by the principals of the selected schools. To ensure maximum cooperation, the investigator introduced themselves to the participants and confirmed their willingness to participate. The respondents were assured that their information would remain anonymous and confidential. The researcher then gathered the data, which included socio-demographic variables from the adolescents, as well as pre-test anthropometric measurements were assessed. Over a period of three months, the adolescents participated in aerobic exercises, which lasted 45 minutes per session, including 15 minutes for warm-up, 30 minutes for exercise, and 15 minutes for cool-down. These sessions were held three times a week. After three months, a post-test was administered to assess obesity.

3. RESULTS

Table No. 1–Distribution of secondary school students according to demographic characteristics.

Demographic Variables		Frequency	Percentage
Age in year	11	16	12.59 %
	12	33	25.98%
	13	23	18.11%
	14	25	19.68%
	15	17	13.38%
	16	13	10.23%
Gender	Male	79	62.20%
	Female	48	37.80%
Resident	Urban	60	47.24%
	Semi urban	36	28.34%
	Rural	31	24.40%
Religion	Hindu	105	118.11%
	Muslim	16	12.59%
	Christian	04	3.14%
	Others, Specify	02	1.57%
Class	5thStandard	16	12.59%
	6th Standard	33	25.98%

Demographic Variables		Frequency	Percentage
	7th Standard	23	18.11%
	8th Standard	25	19.68%
	9th Standard	17	13.38%
	10th Standard	13	10.23%
Number of children in family	One	13	10.23%
	Two	57	44.89%
	Three	40	31.51%
	> Three	17	13.38%
Income of the family	5000 Rs. to 10,000 Rs.	18	14.17%
	11,000 Rs. to 20,000 Rs.	49	38.58%
	21,000 Rs to 25,000 Rs.	41	32.28%
	More than 25,000 Rs.	19	14.96%
Types of family	Nuclear	49	38.58%
	Joint	68	53.54%
	Extended	10	7.87%
Source of information about obesity	School teacher	10	7.87%
	In the radio	19	14.96%
	Books and newspaper	25	19.68%
	Friends at school	30	23.62%
	Relative /Neighbour/ Friends	10	7.87%
	Health Facility	20	15.74%
	Television	8	6.29%
	Other sources	5	3.93%

Above table no.1 reveals that, majority 33 (25.98%) secondary school students were having age of 12 years,79 (62.20%) were male, 60 (47.24%) were from urban resident 105(118.11%) were Hindu,33 (25.98%) were from 6th Standard,57 (44.89%) were having 2 children in their family,49(38.58%) were having monthly income of 11,000 Rs. to 20,000 Rs. 68 (53.54%) were from Joint family,30(23.62%) were received Source of information about obesity from their own Friends at school

Table No-2 Assessment of Anthropometric Measurements among secondary school students.

ANTHROPOMETRIC MEASUREMENTS	**MEAN**	**STD. DEVIATION**
Height pre	151.94	8.63
Height post	152.53	8.65
	Mean	**Std. Deviation**
Body Weight pre	72.75	14.41

Body Weight post	64.82	17.50
	Mean	**Std. Deviation**
Body Mass Index pre	31.28	3.87
Body Mass Index post	27.35	5.09
	Mean	**Std. Deviation**
Waist Circumference pre	84.19	8.43
Waist Circumference post	89.95	12.29
	Mean	**Std. Deviation**
Mid Arm Circumference pre	31.88	2.94
Mid Arm Circumference post	25.28	4.71
	Mean	**Std. Deviation**
Systolic BP pre	105.83	5.11
Systolic BP post	108.43	7.39
	Mean	**Std. Deviation**
Diastolic BP pre	73.24	5.47
Diastolic BP post	67.64	7.29

Table no.3.shows that pre-test and post-test Anthropometric Measurements in relation to height pre-test mean & SD was 151.92± 8.63 and post-test mean & SD was 152.53± 8.65,Body Weight pre-test mean & SD was 72.75 ± 14.41 and post-test mean & SD was 64.82 ± 17.50 Body Mass Index pre-test mean & SD was 31.28± 3.87 and post-test mean & SD was 27.35±5.09, Waist Circumference pre-test mean & SD was 84.19±8.43 and post-test mean & SD was 89.95±12.29,Mid Arm Circumference pre-test mean & SD was 31.88±2.94 and post-test mean & SD was 25.28±4.71,Systolic Blood Pressure pre-test mean & SD was 105.83±5.11 and post-test mean & SD was 108.43±7.39,Diastolic Blood Pressure pre-test mean & SD was 73.24±5.47 and post-test mean & SD was 67.64±7.29

Table No-3 Comparison between Pre Test And Post Test Of Anthropometric Measurements Among Secondary School Students.

Anthropometric Measurements	**N**	**Mean**	**Std. Deviation**	**Paired T Statistic**	**P Value**
Height pre	127	151.92	8.63	1.697	**<0.001**
Height post	127	152.53	8.65		
Body Weight pre	127	72.75	14.41	8.56	**<0.001**
Body Weight post	127	64.82	17.50		
Body Mass Index pre	127	31.28	3.87	4.36	**<0.001**
Body Mass Index post	127	27.35	5.09		
Waist Circumference pre	127	84.19	8.42	5.26	**<0.001**
Waist Circumference post	127	89.95	12.26		
Mid Arm Circumference pre	127	31.88	2.94	17.662	**<0.001**
Mid Arm Circumference post	127	25.27	4.71		

Systolic BP pre	127	105.83	5.11	3.25	**<0.001**
Systolic BP post	127	108.43	7.39		
Diastolic BP pre	127	73.24	5.47	9.38	**<0.001**
Diastolic BP post	127	67.64	7.29		

Table no.3 shows Comparison between Pre Test and Post Test Of Anthropometric Measurements Among Secondary School Students. The pre-test mean and SD of the height was 151.94 ± 8.63 and post-test mean and SD of the height was 152.53 ±8.65 and calculated t value was 9.29 found statistically significant at the level of <0.001.

The pre-test mean and SD of the Body Weight was 72.75 ± 14.41 and post-test mean and SD of the body weight was 64.82 ±17.50 and calculated t value was 8.56 found statistically significant at the level of <0.001.

The pre-test mean and SD of the Body Mass Index was 31.28 ± 3.87 and post-test mean and SD of the Body Mass Index was 27.35 ±5.09 and calculated t value was 4.36 found statistically significant at the level of <0.001

The pre-test mean and SD of the Waist Circumference was 84.19 ± 8.42 and post-test mean and SD of the Waist Circumference was 89.95 ±12.29 and calculated t value was 5.26 found statistically significant at the level of <0.001

The pre-test mean and SD of the Mid Arm Circumference was 31.88 ± 2.94 and post-test mean and SD of the Mid Arm Circumference was 25.27 ±4.71 and calculated t value was 17.662 found statistically significant at the level of <0.001

The pre-test mean and SD of the Systolic Blood Pressure was 105.83± 5.11 and post-test mean and SD of the Systolic Blood Pressure was 108.43 ±7.39 and calculated t value was 3.25found statistically significant at the level of <0.001

The pre-test mean and SD of the Diastolic Blood Pressure was 73.24± 5.47 and post-test mean and SD of the Diastolic Blood Pressure was 67.64 ±7.29 and calculated t value was 9.38 found statistically significant at the level of <0.001

Table No.10 Relationship between socio-demographic factors variables and obesity among secondary school students.

Demographic variables	**BMI**				**Total**	**Chi square statistic**	**p value**
	Underweight	**Normal**	**Overweight**	**Obese**			
Age in year						88.788	0.0001*
11	3	8	4	1	16		
12	0	16	17	0	33		
13	0	6	3	14	23		
14	0	3	15	7	25		
15	1	0	1	15	17		
16	0	0	9	4	13		
Gender						0.8127	0.9367
Males	3	22	30	24	79		
Females	1	11	19	17	48		
Resident						9.127	0.3317
Urban	2	18	18	22	60		
Semi urban	0	7	15	14	36		
Rural	2	8	16	5	31		
Religion						7.468	0.8252
Hindu	3	30	40	32	105		

Demographic variables	BMI				Total	Chi square statistic	p value
	Underweight	Normal	Overweight	Obese			
Muslim	1	2	8	5	16		
Christian	0	1	1	2	4		
Other	0	0	0	2	2		
Class							
5th	3	8	4	1	16		
6th	0	15	15	2	32		
7th	0	7	6	13	26	79.621	0.0001*
8th	1	3	13	6	23		
9th	0	0	0	14	14		
10th	0	0	11	6	16		
No of children in family							
One	0	1	7	5	13		
Two	1	13	18	24	56	23.010	0.0276*
Three	1	9	19	11	40		
> Three	2	10	4	1	17		
Income of family							
Rs. 5000- Rs. 10000	0	3	6	9	18		
Rs. 11000- Rs. 20000	1	6	22	20	49	21.343	0.0456*
Rs. 21000- Rs. 25000	3	18	11	9	41		
>Rs. 5000	0	6	9	3	18		
Types of family							
Nuclear	2	8	17	21	48	7.324	0.5021
Joint	2	23	26	17	68		
Extended	0	2	5	3	10		
Age of Mother							
< 25 yrs.	0	1	1	3	5		
25-30 yrs	2	16	13	8	39	18.438	0.2989
31-35 yrs	1	13	31	29	74		
36-40 yrs	1	3	3	0	7		
>40 yrs	0	0	1	1	2		
Age of Father						25.263	0.0136*
25-30 yrs	1	4	1	0	6		

Demographic variables	BMI				Total	Chi square statistic	p value
	Underweight	Normal	Overweight	Obese			
31-35 yrs	1	17	14	8	40		
36-40 yrs	1	12	28	32	73		
>40 yrs	1	2	4	1	8		
Type of Mother diet						12.406	0.1340
Vegetarian	0	18	30	31	79		
Non vegetarian	1	2	6	3	12		
Mixed	3	13	13	7	36		
Type of Father diet						21.256	0.0065*
Vegetarian	0	9	1	3	13		
Non vegetarian	0	8	22	21	51		
Mixed	4	16	26	17	63		
Education of Mother							
No formal	0	3	9	4	16	22.375	0.1315
Primary	2	11	21	30	64		
Secondary	1	11	11	7	30		
College/ University	1	8	6	0	15		
No response	0	0	1	0	1		
Education of Father						6.213	0.9050
Primary	0	5	4	4	13		
Secondary	3	12	22	23	60		
College/ University	1	16	22	13	52		
No response	0	0	1	1	2		
Occupation of Mother						44.287	0.0001*
Housewife	2	14	33	27	76		
Buisness	2	10	10	8	30		
Farmer	5	4	0	6	15		
Government employee	4	0	2	0	6		
Occupation of father						9.215	0.6845
Housewife	0	0	0	1	1		
Buisness	3	13	14	13	43		

Demographic variables	BMI				Total	Chi square statistic	p value
	Underweight	Normal	Overweight	Obese			
Farmer	1	13	29	22	65		
Government employee	0	7	7	4	18		
Source of information about obesity							
School teacher	0	2	6	2	10		
In the Radio	0	2	10	7	19		
Books and Newspaper	2	4	8	11	25		
Friends at school	1	11	9	9	30	31.566	0.2925
Relative/ Neighbour/ Friends	1	4	1	4	10		
Health facility	0	4	7	9	20		
Television	0	2	6	0	8		
Other sources	0	4	1	0	5		

Table no.10 show there was significant association between sociodemographic variables of Age in year, Class, No of children in family, Income of family, Age of Father, Type of Father diet, Occupation of Mother with obesity at the level of $p<0.05$

4. DISCUSSION

The World Health Organization (WHO) defines obesity as "abnormal or excessive fat accumulation that presents a risk to health.[9]

Overweight and obesity are major contributors to global mortality, responsible for more than 4 million deaths annually. Obesity in children and adolescents is linked to genetic influences, socioeconomic factors, and behaviors such as lack of physical activity, poor diet (low fruit/vegetable intake), insufficient sleep, sedentary habits (e.g., watching TV, playing video games), consumption of sugary drinks, junk food, as well as smoking and alcohol use.[10]

Higher BMI, particularly during adolescence, is associated with an increased risk of various health issues, including metabolic conditions like elevated fasting glucose, impaired glucose tolerance, type 2 diabetes (T2DM), metabolic syndrome, and fatty liver disease.[11]

In India, about 18.3% of age group female adolescents aged 2–17 years is either in the category of overweight or obese.[12]Adolescent overweight and obese people at younger stages of their lives may develop various non-communicable diseases, such as diabetes and cardiovascular diseases[13]Owing to lifestyle changes, such as balanced organic foods to processed foods, more cell phone and television use, a more sedentary lifestyle, and a decrease in physical activity may be risk factors for teenage obesity.[14]

The result of the present study shows pre-test mean and SD of the Body Mass Index was 31.28± 3.87 and post-test mean and SD of the Body Mass Index was 27.35 ±5.09 and calculated t value was 4.36 found statistically significant at the level of <0.001.

The findings of the present study align with those of **Mahalakshmi B. et al**[15] who conducted a quasi-experimental study involving 60 school-age children in Visnagar, Gujarat, India. This 12-week aerobic the exercise program was carried out three times weekly, included activities such as running, jumping jacks, and dance routines. Pre-test results indicated that 80% of children were classified as overweight, which decreased to 58.3% after the intervention. The mean BMI significantly dropped from 24.41 to 22.84 ($p < 0.05$), demonstrating the positive effect of aerobic exercise.

Gomes PP et al.[16] conducted A study aimed at assessing the effect of different intensities of aerobic training on the body composition of obese adolescents undergoing a multidisciplinary intervention. The study involved 107 pubertal adolescents (Tanner stages 3 and 4) with a mean BMI of 34.72 ± 4.10 kg/m² and an average age of 14.85 ± 1.44 years. Participants received nutritional, psychological (weekly), and clinical (monthly) follow-up, along with physical training three times a

week for 12 weeks. The results revealed BMI reduction was observed only in the experimental groups (p<0.001). the study found that multidisciplinary treatment positively affected the body composition of obese adolescents, and these effects were independent of the intensity of the aerobic physical training.[17]

Ms. Richa R. Jadhav et al. [118] conducted a quasi-experimental study in two schools in Kolhapur, Maharashtra, with 30 participants (15 in the control group and 15 in the experimental group). A pilot study was initially carried out with 8 participants, followed by the main study. After consulting with experts, a validated questionnaire tool was developed. The study included overweight and obese adolescents, and anthropometric parameters such as height, weight, and body mass index (BMI) were recorded. Aerobic exercise was provided for one month under the guidance of a trained instructor. After one month, anthropometric measurements were reassessed. The differences between the parameters were analyzed using the Wilcoxon signed rank test, with a p-value of <0.05 considered significant. The results showed a significant reduction in weight (P = 9.14e-07), BMI (P = 1.805e-06), and waist-to-hip ratio (P = 0.0005) in the experimental group, while no significant changes were observed in the control group. The study concluded that aerobic exercise significantly aids in weight reduction among overweight and obese adolescents, indicating that such interventions should be incorporated into school and community programs.

For Confirming the result of the present study it can be pointed out the study conducted by **Deepa Singh et al. (2025),** A Pre- experimental one group pre-test and post-test design was used to evaluate the effectiveness of aerobic exercise on obesity among adolescents in selected school of Jabalpur, Madhya Pradesh. The sample consisted of 60 adolescents (11-16 years) students, who are available at the time of study. Non-probability purposive sampling method was used for the selection of samples. The instrument for the data collection was BMI classification to perceived level of BMI and teaching aerobic exercise. The mean post-test perceived level of BMI is significantly less than the mean pre-test perceived level of BMI that is 23.65 inpre-testand21.59 in post-test with paired t-value=2.59 at P =0.05 level of significance. The results of major findings indicated that adolescent (11-16 years) students had decreased the perceived level of BMI. Aerobic exercise was found to be a very effective method of providing information regarding reducing obesity among adolescents.[18]

In a randomized controlled trial conducted by **Haiying J. et al (2020)** 40 young volunteers were randomly assigned to either the experimental or control group. The control group did not undergo any intervention while the experimental group followed a professionally Developed an aerobic exercise regimen for 28 days. Training data were collected before, during, and after the exercise sessions, then analyzed and compared. The control group did not show significant reductions in body fat, whereas the experimental group, which participated in aerobic exercise, demonstrated greater improvements in reducing body weight, body fat, waist-to-hip ratio, and overall weight loss compared to the control group.[19]

5. CONCLUSION

In conclusion, the study on the "Effectiveness Aerobic Exercise on Obesity among Secondary School Students" has provided valuable insights into the impact of structured health interventions on the prevention and management of obesity among adolescents. The findings indicate that physical activity can significantly reduce obesity among Secondary School Students. The intervention demonstrated positive changes in students' dietary habits, physical activity levels, and overall health awareness, leading to a reduction in obesity prevalence. Furthermore, it highlighted the importance of involving students, teachers, and parents in fostering a supportive environment for sustained health changes.

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