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Correlation between obesity and cardiopulmonary capacity in school going children of Navsari City

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Abstract

Background: Childhood obesity is a burgeoning global public health concern, posing significant risks to cardiovascular and respiratory health. This study aimed to explore the correlation between obesity and cardiopulmonary capacity among school-going children aged 8 to 16 years in Navsari, India.

Methods: A correlational study was conducted, involving a convenient sample of 55 school children. Body mass index (BMI) was calculated, and participants underwent the 6-minute walk test (6MWT) to evaluate cardiopulmonary capacity. Maximum oxygen uptake (VO_2max) was estimated utilizing a prediction equation based on 6MWT distance and BMI.

Results: Analysis revealed a noteworthy negative correlation between BMI and VO_2max ($r = -0.874$, $p < 0.001$), indicating that heightened obesity levels corresponded to diminished cardiorespiratory fitness. The 6MWT emerged as a dependable and valid measure for assessing aerobic capacity in obese youth.

Conclusion: In conclusion, the study on the correlation between obesity and cardiopulmonary capacity in school-going children of age 8 to 16 years of Navsari city, India; reinforced strong negative correlation between BMI and maximum oxygen uptake (VO_2max), indicating that higher levels of obesity were associated with reduced cardiopulmonary capacity.

Keywords: Childhood obesity, cardiopulmonary capacity, VO_2max, 6-minute walk test, body mass index, school children

Introduction

Childhood obesity has emerged as a pressing global health concern, with its prevalence escalating at an alarming rate in both developed and developing nations. The World Health Organization has identified childhood obesity as one of the most serious public health challenges of the 21st century [1]. In India, the prevalence of obesity among children and adolescents has risen significantly in recent decades, driven by factors such as sedentary lifestyles, unhealthy dietary habits, and rapid urbanization [2].

Obesity in childhood is associated with numerous adverse health consequences, including an increased risk of cardiovascular diseases, type 2 diabetes, and respiratory disorders [3]. Of particular concern is the impact of obesity on cardiopulmonary capacity, which refers to the ability of the cardiovascular and respiratory systems to supply oxygen during physical activity [4]. Reduced cardiopulmonary capacity can lead to decreased exercise tolerance, fatigue, and a diminished quality of life, further exacerbating the negative consequences of obesity [5].

Assessing cardiopulmonary capacity is crucial for identifying individuals at risk and developing appropriate interventions. The six-minute walk test (6MWT) has emerged as a reliable and widely used method for evaluating functional exercise capacity in various populations, including obese children and adolescents [6,7]. The 6MWT measures the distance an individual can walk on a flat surface in six minutes, providing an estimate of their maximal oxygen uptake (VO_2max), a key indicator of cardiopulmonary fitness [8].

Despite the increasing prevalence of childhood obesity and its potential impact on cardiopulmonary health, there is a paucity of research investigating the correlation between obesity and cardiopulmonary capacity in specific geographic regions. Understanding this relationship within a local context is essential for developing targeted interventions and preventive strategies tailored to the unique needs and characteristics of the community [9]. The present study aims to address this gap by investigating the correlation between obesity and cardiopulmonary capacity among school-going children aged 8 to 16 years in Navsari, India.

Methodology

- **Study design:** Correlational study
- **Sample design:** Convenient sampling
- **Sample population:** School-going children aged 8 to 16 years both male and female.
- **Sample size:** 55 [6] (As per the time-bound nature of the study)
- **Study setting:** Schools located in Navsari city.
- **Study duration:** 6 Months

Material Used

- Measurement scale in meter
- Non-adhesive measure tape
- Weighing machine
- Two small cones to mark the turn around points
- A chair that can be easily moved along the walking course
- Countdown Timer (or stopwatch)
- Calculator or Mobile phone
- Chalk
- Red marking at the starting point
- Worksheets on a clipboard
- First aid
- BMI graph [20]

Sampling Criteria

Inclusion Criteria

- Children aged between 8 to 16 years both male and female [2].
- Body Mass Index (BMI) above the 95th percentile for age and sex, based on the WHO growth reference standards [2].
- Ability to comprehend and adhere to instructions [2].
- Consent signed from parents or guardian or caregivers [2].
- Willing participants.

Exclusion Criteria

- Children diagnosed with metabolic syndrome, severe/chronic cardiac, or neurological disorders [2].
- History of acute or chronic cardiopulmonary diseases [2].
- Previous history of musculoskeletal injuries [2].
- Children with significant coordination and balance disorders predisposing them to falls, as determined by a comprehensive medical history [2].
- Those already engaged in exercises other than routine exercises [2].

Result

The study involved 55 school-going children aged between 8 to 16 years from Navsari city. Their cardiopulmonary capacity, represented by VO_2max, was assessed using the 6-minute walk test (6MWT).

The data for BMI and VO_2max were normally distributed, while the data for 6MWD was not normally distributed.

Table 1: Describes variables including Mean, Median, Standard deviation of BMI, VO_2max and Distance.

Variables	Mean ± sd
BMI	29.921 ±3.99169
VO_2max	22.8438±1.99598
Distance	5.2284±7.01368

The mean BMI of the participants was 29.93 kg/m2, which falls in the obese category. The mean VO_2max was 22.84 ml/kg/min.

Table 2: The normality of data distribution including BMI, VO_2max & distance.

	Kolmogorov- Smirnov		
	Statistic	Df	Sig.
BMI	0.102	55	0.200*
VO_2max	0.65	55	0.200*
Distance	0.127	55	0.027

*. This is a lower bound of the true significance

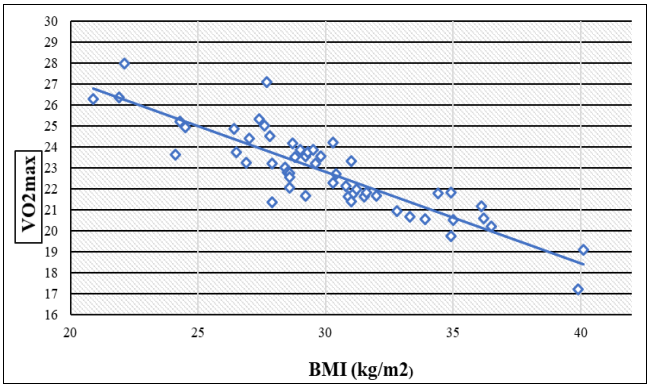
Table 2 represents the normality of the data distribution indicate that the data for BMI and VO_2max were normally distributed ($p > 0.05$), while the data for distance was not normally distributed ($p = 0.027$).

Table 3: Relationship between obesity (BMI) and cardiopulmonary capacity (VO_2max), Pearson's correlation coefficient was calculated.

Variable		VO_2max
BMI	Pearson Correlation (r)	-.874**
	Sig. (2-tailed) (p Value)	.000
	N	55

**. Correlation is significant at the 0.01 level (2 tailed)

Table 3 reveals There was a strong negative correlation between BMI and VO_2max ($r = -0.874$, $p < 0.001$).



Graph 2: Relationship between obesity (BMI) and cardiopulmonary capacity (VO_2max), were calculated and scatter diagram was plotted accordingly.

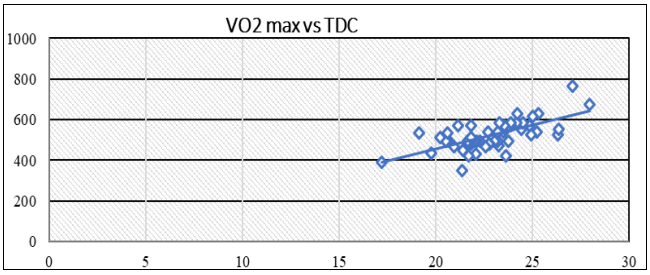
This indicates that as the children's BMI (obesity level) increased, their VO_2max (cardiopulmonary capacity) decreased.

Table 4: Examines the relationship between VO_2max and 6MWD of the participants.

Variable		Distance
VO_2max	Pearson Correlation (r)	.671**
	Sig. (2-tailed) (p Value)	.000
	N	55

**. Correlation is significant at the 0.01 level (2 tailed)

Table 4 reveals there was a positive correlation between VO_2max and the 6-minute walk distance (6MWD) ($r = 0.671$, $p < 0.001$), as both are indicators of cardiorespiratory fitness.



Graph 3: Represents the relationship between VO_2max and 6MWT of the participants.

The above graph represents positive corelation between VO_2max and 6MWD as both measures are indicators of cardiorespiratory fitness.

The data for BMI and VO_2max were normally distributed, while the data for 6MWD was not normally distributed.

Dicussion

The results of this study on the correlation between obesity and cardiopulmonary capacity in school-going children of Navsari city are consistent with findings from several other studies in this area.

The study's primary finding was a strong negative correlation between body mass index (BMI) and maximum oxygen uptake (VO_2max) among the obese school children ($r = -0.874$, $p < 0.001$). This inverse relationship between increased adiposity and reduced cardiorespiratory fitness is well-documented in the literature.

Similar findings have been reported by Grzyb *et al.* (2021) [6], who observed that obese children and adolescents

exhibited significantly lower VO_2 peak values relative to their body weight when compared to normal-weight and overweight peers [6]. Dobrowolska *et al*. (2022) [12] also found a significant correlation between fat-free mass and absolute aerobic capacity (VO_2 peak) in children and youth with elevated BMI [12].

The diminished cardiorespiratory capacity in obese children is attributed to the increased metabolic demand placed on the cardiovascular and respiratory systems during physical exertion, leading to premature fatigue and reduced exercise tolerance [6, 15]. Additionally, obesity is often accompanied by sedentary lifestyles and decreased levels of physical activity, further exacerbating the decline in cardiopulmonary fitness [6].

The present study employed the 6MWT as the assessment tool to evaluate cardiopulmonary capacity, aligning with the recommendations in the literature. The 6MWT has been widely used and validated for assessing functional exercise capacity in various populations, including obese children and adolescents [9, 10].

Morinder *et al*. (2008) and Li *et al*. (2005) [10] have previously established the 6MWT as a reliable and valid test for evaluating exercise tolerance and endurance in obese youth and healthy children, respectively [9, 10].

Vanhelst *et al*. (2013) [11] demonstrated that the distance walked during the 6MWT and BMI are the most significant factors in predicting VO_2max in obese youth, highlighting the utility of this prediction equation [11]. Interventions targeting weight management and 34 increased physical activity levels have the potential to prevent or ameliorate the adverse consequences of obesity on cardiorespiratory health and overall well-being in children. [6, 14]

As noted by Ahirwar and Mondal (2019) [2], childhood obesity has become a global public health crisis, with a rising prevalence driven by various factors, such as sedentary lifestyles and unhealthy dietary habits [2]. Tackling this issue through comprehensive, community-based strategies is essential to safeguard the long-term cardiovascular and respiratory health of children.

In conclusion, the present study's findings are well-aligned with the existing literature, reinforcing the negative impact of obesity on cardiorespiratory fitness in school-going children. The consistent use of reliable assessment tools, such as the 6MWT, and the application of predictive equations further strengthen the comparability and validity of the results across these studies. The collective evidence underscores the urgency of addressing childhood obesity through targeted interventions and preventive measures to promote overall health and well-being in this population.

Summary

The study found a significant negative correlation between obesity levels (BMI) and cardiopulmonary capacity (VO_2max) in obese school children aged 8-16 years in Navsari city. Higher BMI values were associated with lower VO_2max, indicating reduced cardiorespiratory fitness in obese children.

Conclussion

In conclusion, the study on the correlation between obesity and cardiopulmonary capacity in school-going children of age 8 to 16 years of Navsari city, India; reinforced strong negative correlation between BMI and maximum oxygen uptake (VO_2max), indicating that higher levels of obesity were associated with reduced cardiopulmonary capacity.

References

1. McArdle WD, Katch FI, Katch VL. Exercise physiology: nutrition, energy, and human performance. Lippincott Williams & Wilkins, 2010.
2. Ahirwar R, Mondal PR. Prevalence of obesity in India: a systematic review. Diabetes Metab Syndr Clin Res Rev,2019:13(1):318–21.
3. Freedman DS, Sherry B. The validity of BMI as an indicator of body fatness and risk among children. Pediatrics,2009:124(Suppl 1):S23–34.
4. Carayanni V, Bogdanis GC, Vlachopapadopoulou E, Koutsouki D, Manios Y, Karachaliou F, *et al*. Predicting VO_2max in children and adolescents aged between 6 and 17 using physiological characteristics and participation in sport activities: a cross-sectional study comparing different regression models stratified by gender. Children,2022:9(12):1935.
5. Buttar KK, Saboo N, Kacker S. A review: maximal oxygen uptake (VO_2max) and its estimation methods. IJPESH,2019:6(6):24–32.
6. Grzyb A, Domagalska-Szopa M, Siwiec A, Kwiecień-Czerwieniec I, Szopa A. Cardiopulmonary capacity in overweight and obese children and adolescents: a cross-sectional study. Front Physiol,2021:12:671827.
7. Safaei M, Sundararajan EA, Driss M, Boulila W, Shapi'i A. A systematic literature review on obesity: understanding the causes & consequences of obesity and reviewing various machine learning approaches used to predict obesity. Comput Biol Med,2021:136:104754.
8. Himes JH. Challenges of accurately measuring and using BMI and other indicators of obesity in children. Pediatrics,2009:124(Suppl 1):S3–22.
9. Morinder G, Mattsson E, Sollander C, Marcus C, Larsson UE. Six-minute walk test in obese children and adolescents: reproducibility and validity. Physiother Res Int,2009:14(2):91–104.
10. Li AM, Yin J, Yu CC, Tsang T, So HK, Wong E, *et al*. The six-minute walk test in healthy children: reliability and validity. Eur Respir J,2005:25(6):1057–6.
11. Vanhelst J, Fardy PS, Salleron J, Béghin L. The six-minute walk test in obese youth: reproducibility, validity, and prediction equation to assess aerobic power. Disabil Rehabil,2013:35(6):479–82.
12. Dobrowolska A, Domagalska-Szopa M, Siwiec A, Szopa A. Association between cardiopulmonary capacity and body mass composition in children and adolescents with high body weight: a cross-sectional study. Children,2022:9(5):647.
13. Eshwar TM, Chudasama RK, Eshwar ST, Thakrar D. Prevalence of obesity and overweight and their comparison by three growth standards among affluent school students aged 8–18 years in Rajkot. Indian J Public Health,2017:61(1):51.
14. Shah H, Mali S, Ranga S, Jadhav C, Rukadikar A, Singh AK, *et al*. Effect of body mass index on cardiorespiratory parameters among medical students: a cross-sectional study. Int J Physiol Pathophysiol Pharmacol,2022:14(1):4.
15. Serés L, López-Ayerbe J, Coll R, Rodríguez O, Manresa JM, Marrugat J, *et al*. Cardiopulmonary function and exercise capacity in patients with morbid obesity. Rev Esp Cardiol,2003:56(6):594–600.

16. Parekh A, Parekh M, Vadasmiya D. Prevalence of overweight and obesity in adolescents of urban & rural area of Surat, Gujarat. Natl J Med Res,2012:2(3):325–9.
17. Himes JH. Challenges of accurately measuring and using BMI and other indicators of obesity in children. Pediatrics,2009:124(Suppl 1):S3–22.
18. American Thoracic Society. ATS statement: guidelines for the six-minute walk test. Am J Respir Crit Care Med,2002:166:111–7.
19. Racette SB, Yu L, DuPont NC, Clark BR. BMI-for-age graphs with severe obesity percentile curves: tools for plotting cross-sectional and longitudinal youth BMI data. BMC Pediatr,2017:17(1):1–7.
20. Enright PL. The six-minute walk test. Respir Care,2003:48(8):783–5.
21. Morinder G, Mattsson E, Sollander C, Marcus C, Larsson UE. Six-minute walk test in obese children and adolescents: reproducibility and validity. Physiother Res Int,2009:14(2):91–104.
22. Racette SB, Yu L, DuPont NC, Clark BR. BMI-for-age graphs with severe obesity percentile curves: tools for plotting cross-sectional and longitudinal youth BMI data. BMC Pediatr,2017:17(1):1–7.
23. Enright PL, Sherrill DL. Reference equations for the six-minute walk in healthy adults. Am J Respir Crit Care Med,1998:158(5):1384–7.