

Association of Chest Expansion and Functional Capacity among School Going Children

Sakshi Naimish Shah¹, Mansee Desai²

¹Second Year MPT Student, JG College of Physiotherapy, Ahmedabad

²Lecturer and Guide at JG College of Physiotherapy, Ahmedabad

Corresponding Author: Sakshi Shah

DOI: <https://doi.org/10.52403/ijhsr.20220338>

ABSTRACT

Background: Modern age children are fatter, less physically active as well as less physically fit than in the past. This era of technological evolution has significantly affected the lifestyle activities of children with more adherence to mobile phones, televisions etc. This has thus led to decreased opportunities for children to engage in physical activities such as outdoor games. Children these days have hence adapted a sedentary lifestyle which lacks cardiopulmonary boosting in children. They prefer passive source of entertainment like laptops, cell phone which has impacted their physical health to greater extent. Lack of functionality (physical activity) has also been impacting their cognition as well as mental well-being

Purpose: To assess functional capacity of children which can quantify their physical well-being and also correlate it with chest expansion

Methodology: 50 subjects were taken from residential area of Ahmedabad city from whom prior consent was taken. Chest expansion was measured using standard inch tape method followed by 6 minute walk test to test their functional capacity, rate of perceived exertion was taken post exercise testing.

Results: According to statistical analysis there is poor correlation between chest expansion and functional capacity among children

Conclusion: There is no association between chest expansion and functional capacity however there is significant lack of knowledge amongst children regarding physical well-being and adverse effects of being inactive.

Key Words: Physical activity, Children, Chest expansion, Functional capacity

INTRODUCTION

Physical activity is a very vital part of a growing child and there are various evidences related to the biological and psycho-social health benefits of physical activity in school-aged children and youth.¹ The basic recommendation however was that school- going children and youth irrespective of their current physical activity level, should increase the time they spend on moderate-to-vigorous intensity of physical activity by 30 minutes per day and over a 5 month period it should progress to adding an additional 90 minutes of daily

physical activity be it either moderate intensity or vigorous intensity.¹ There is also this concept adapted by Canadian government which is “24 hour movement” which encircles the concept of “The whole day Matters”.² It has been shown that physical activity has a linear relationship with the health benefits which is suggestive that greater the physical activity greater will be the health benefits however it has been noted that as children are typically growing their physical activity is lot less than required which has become a global issue.³ Even modest amounts of physical

activity can have substantial benefits on health however it should be noted that there is wide variety and equivalent bouts of moderate and vigorous physical activity.^[1]

An individual's response to exercise or physical activity is an important clinical assessment tool, since it provides a composite assessment of their respiratory, cardiac and metabolic systems.^[4] The ability to walk a set distance is a quick, easy and inexpensive way to assess physical function.^[4] It is also an important component of overall quality of life since it reflects the capacity to perform day-to-day activities.^[4] The current gold standard for assessing the aerobic exercise response is the maximum incremental cardiopulmonary exercise test but since most daily activities are performed at submaximal levels of exertion, submaximal functional tests are more appropriate as it allows a better reflection of physical capability.^[5] The 6 minute walk test used in the current study is an easy to perform and cost-effective technique which has been proposed as the best indicator for testing functional capacity at submaximal level.^[5]

Exercise capacity or functional capacity expresses an individual's ability to perform submaximal activities that require the integrated efforts as well as sound health of the pulmonary, cardiovascular and also skeletal muscle systems and also a clinical trial done on patients with chronic obstructive pulmonary disease demonstrated that pulmonary function was positively correlated with reduction of chest wall expansion.^[6]

This study was thus initiated in order to assess the functional capacity of children since several sources have reported that children and youth spend the majority of their discretionary time engaging in sedentary pursuits (e.g. watching television (TV) or playing video games) which ultimately is associated with increased risk of cardio-metabolic disease, all-cause mortality, and a variety of physiological and psychological problems.^[7]

Unfortunately, owing to the increased importance that has been placed on formal academic instruction, time spent on physical activity has been progressively reduced within the scholastic environment which is why it becomes necessary to determine how different aerobic fitness tests be it lab tests or field tests and certain individual demographic characteristics such as chest expansion to investigate its impact.^[8]

Chest expansion is an easy and effective method to measure the chest wall mobility.^[9] However it should not be ignored that chest wall mobility is dependent on various factors such as elasticity of soft tissue structures surrounding the thorax, chest shape, and strength of the respiratory muscles and also that the degree of chest expansion is not merely due to movement of the rib cage and the external intercostal muscle expanding the transverse dimensions, but it is also associated with contraction of the diaphragm amid expanding the vertical diameter of the thoracic cavity.^[6]

METHOD

We conducted this study using purposive sampling where children from residential areas of Ahmedabad city and those falling under the age bracket of 6-12 years were selected. Prior consent was taken from their respective guardians and all their concerns and queries were respectfully answered. Children were prepared for the test by asking demographic details consisting of age and gender to make them comfortable and also form a rapport with them.

Total of 56 subjects were selected for the study however 6 of the subjects were excluded as they did not fit within the inclusion criteria. Few limitations such as presence of any behavioral, cognitive or motor function which is capable of compromising the accomplishment of the test and also children with evidence of any cough, wheezing, expectoration and dyspnea were excluded from the study.

Children who had any recent history of cough were reevaluated a week after to maximize the efficiency of the child to perform the tests

Children were then measured for chest expansion using the simple non-elastic measure tape. The children were firstly demonstrated with the test and taught about the purpose and possible outcomes of the same. The measurement was taken at 3 levels:

1. Axillary level
2. Nipple area and lastly
3. Xiphisternum area.

The children were advised to inhale maximally followed by maximal exhalation and the difference obtained was measured at 3 different level and since children can show difficulties in understanding the test completely, the test was performed 3 times at each level and the best result out of 3 was concluded to be the final chest expansion for each subject.

After the chest expansion measurement, children were tested for their functional capacity using the 6 minute walk test. The children again were taught the test and its respective purpose along with possible outcomes were also explained to the children. Children were made to walk in a 10-meter long corridor with no hurdles and were instructed to walk at a normal pace. The walking was continued for 6 meters followed by modified Borg scale administration which grades the amount of exhaustion children have experienced after the 6-minute walk.

Children throughout the duration of study were optimistically addressed to not let stress or nervousness hinder their performance and to obtain as realistic results as possible.

Statistical Analysis

The data was collected from 50 subjects and the data is analyzed using SPSS version 20.0. The data consisted was 50 subjects (n=50, female =20 and male =30). The confidence interval for this study was 95% and the level of significance was

0.05. At first the test was normality was done using the Shapiro wilk test which showed the p value less than 0.05 which made the data non-parametric. The data was further analyzed using Spearman's test for correlation where 2 variables of the study chest expansion and functional capacity were correlated. The correlation co-efficient obtained from this test was -0.093.

RESULT

Total of 50 subjects were obtained and further tested for the study. Of this 50 subjects there were 20 subjects were female and 30 subjects were male.

The mean age obtained for this study is 9.26 ± 2.00 . The chest expansion was obtained by best of 3 attempts and a mean value of 3 different areas tested for chest expansion which is 2.3 ± 0.55 . Mean value for modified Borg scale followed by 6-minute walk test for 50 subjects is 1.27 ± 0.52 .

The statistical analysis for this study has been done using SPSS version 20.0. The data was first tested for the normal distribution using the Shapiro wilk test and data was not normally distributed ($p < 0.05$) which makes the data a non-parametric data.

TEST OF NORMALITY			
SHAPIRO-WILK TEST			
STATISTICS		Df.	Sig.
CHEST EXPANSION	0.848	50	0.000
FUNCTIONAL CAPACITY	0.730	50	0.000
AGE	0.925	50	0.002

Further the two variables that are chest expansion and functional capacity were correlated to analysis the type of linear relationship they possess. The correlation was done using Spearman's correlation testing.

CORRELATION			
		Chest Expansion	Functional Capacity
Chest Expansion	Correlation coefficient	1	-0.093
	Sig. (2-tailed)		0.520
	N	50	50
Functional Capacity	Spearman correlation	-0.093	1
	Sig. (2-tailed)	0.520	
	N	50	50

The 2 variables that are chest expansion and functional capacity thus according to the statistical analysis possess a weak correlation ($\rho = 0.093$) which is negative in nature.

DISCUSSION

The study was conducted to assess the relationship between chest expansion and functional capacity of the child and to evaluate if the 2 variables could be used in an interchangeable manner since the sedentary lifestyle of children is increasing and the physical activity of child is compromised to a greater extent.

Functional capacity of children was considered in this study as it can quantify the physical well-being of the children. 6 minute walk test was thus chosen to be the most appropriate test for the same. The six-minute walking test as described by Andrade F. et al as the submaximal test which is applied in patients with cardiac and/or pulmonary disease, whose results portrays both aspects of quality of life and also of the patient's performance for activities of daily living (ADLs) along with that it is also considered an important alternative to replace the maximum effort tests which even though elected as the gold standard to estimate tolerance to efforts as they are difficult to execute for the normal children as they demand both high-cost equipment as well as the recruitment of specialized staff.^[10]

Chest expansion can be an important measure when we are exploring the reasons for decreased exercise tolerance in the subjects^[11] and it is also considered that it is the verbal instruction during measurement of chest expansion which is of utmost importance when measuring by tape and also to assess the maximal range of motion in the chest, the patient should be instructed not only to "breathe in/out maximally", but also to "make yourself as big/small as possible"^[11]

The idea behind conducting this study was to evaluate whether chest expansion shows linear relationship with

functional capacity or not. In case of positive and strong correlation of these 2 variables, chest expansion could be replaced with physical activity as the rate of sedentary behaviors in children is increasing as their age progresses which ultimately decreases the functional capacity of the children.

This is a one of a kind conducted in young school going children aged 6-12 years and there is lack of such studies which could be used for comparison or correlation purposes.

However there are various studies which has shown contradicting results as compared to the recent study. Padkao T. et al in their study correlated respiratory muscle strength, chest wall expansion and functional capacity in healthy non-smokers. This study thus concluded that there is weak relationship between all these variables.^[6]

Another study conducted by Sharma N. et al which they have correlated functional capacity, pulmonary function and chest expansion in children undergoing open abdominal surgery showed that there is poor correlation of functional capacity with pulmonary function and chest expansion.^[9]

CONCLUSION

The study conducted thus concludes that there is poor relationship between chest expansion and functional capacity amongst typically developing children aged 6-12 years.

However, the study also shows certain limitations such as the study is conducted in a relatively limited population and it could have been conducted in a larger population. In this study, we also opted for 1 objective tool for measuring functional capacity (6-minute walk test) which can create bias as it is dependent on the subject. There are various systems which can affect the chest expansion such as soft tissue mobility, chest wall structure etc which has not been considered in this study.

Further study could be conducted from a gender perspective, if males or females shows any differences in chest

expansion or functional capacity. Secondly, various other cardio-pulmonary parameters such as blood pressure can be further correlated with either chest expansion or functional capacity.

In perspective of clinical significance this study shows that the functional capacity of the children cannot be improved by chest expansion exercises and also that there is no alternative of physical activity for children to improve their functional capacity and overall health.

Acknowledgement: None

Conflict of Interest: None

Source of Funding: None

Ethical Approval: Approved

REFERENCES

1. Janssen I, LeBlanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International journal of behavioral nutrition and physical activity*. 2010 Dec; 7(1):1-6.
2. Tremblay MS, Carson V, Chaput JP, Connor Gorber S, Dinh T, Duggan M, Faulkner G, Gray CE, Gruber R, Janson K, Janssen I. Canadian 24-hour movement guidelines for children and youth: an integration of physical activity, sedentary behaviour, and sleep. *Applied Physiology, Nutrition, and Metabolism*. 2016;41(6): S311-27.
3. Reilly J. The pandemic of low physical activity in children and adolescents. *Aspetar Sports Medicine Journal*. 2015 May 1;4(May):234-8.
4. Li A M. et al. The six minute walk test in healthy children: reliability and validity. *European respiratory journal*. 2005
5. Enright PL. The six-minute walk test. *Respir Care* 2003; 48: 783–785.
6. Padkao T, Boonla O. Relationships between respiratory muscle strength, chest wall expansion, and functional capacity in healthy nonsmokers. *Journal of exercise rehabilitation*. 2020 Apr;16(2):189.
7. Tremblay MS, LeBlanc AG, Kho ME, Saunders TJ, Larouche R, Colley RC, Goldfield G, Gorber SC. Systematic review of sedentary behaviour and health indicators in school-aged children and youth. *International journal of behavioral nutrition and physical activity*. 2011 Dec;8(1):1-22.
8. Álvarez-Bueno C, Hillman CH, Cavero-Redondo I, Sánchez-López M, Pozuelo-Carrascosa DP, Martínez-Vizcaíno V. Aerobic fitness and academic achievement: A systematic review and meta-analysis. *Journal of sports sciences*. 2020 Mar 3;38(5):582-9.
9. Sharma N, Sree BS, Aranha VP, Samuel AJ. Repeated measures correlation between functional capacity, pulmonary function and chest expansion in children undergoing open abdominal surgery: Secondary analysis from randomized clinical trial. *Journal of Pediatric Surgery*. 2021 Nov 1;56(11):2022-6.
10. Andrade FS, Teixeira RD, Araújo DA, Barbosa TR, Sousa FD, Cruz RV. Lung function and functional capacity in school age children. *Fisioterapia em Movimento*. 2017 Jan;30:77-84.
11. Olsen MF, Lindstrand H, Broberg JL, Westerdahl E. Measuring chest expansion; A study comparing two different instructions. *Advances in Physiotherapy*. 2011 Sep 1;13(3):128-32.

How to cite this article: Shah SN, Desai M. Association of chest expansion and functional capacity among school going children. *Int J Health Sci Res*. 2022; 12(3): 269-273. DOI: <https://doi.org/10.52403/ijhsr.20220338>
