International Journal of Research in Social Sciences
Vol. 8 Issue 7, July 2018,
ISSN: 2249-2496 Impact Factor: 7.081
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gage as well as in Cabell's Directories of Publishing Opportunities, U.S.A

COMPARATIVE STUDY ON THE PEAK EXPIRATORY FLOW RATE OF SCHOOL CHILDREN(10 – 14 YEARS) IN THE UNION TERRITORY OF PUDUCHERRY

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Abstract

Peak Expiratory Flow Rate of children has been known to vary with region. The present study aimed to compare the airway patency of school children (10 – 14 years)in each of the 4 regions of the Union Territory of Puducherry based on PEFR zones. A cross sectional study was conducted among 1926 school children selected by stratified random sampling method. Anthropometric measurements and Peak Expiratory Flow Rate were assessed using .prescribed standardized tools such as stadiometer, weighing machine, non-stretchable flexi tape and Mini Wright peak flow meter. Data was analyzed using SPSS 19.0 version.The results revealed a significant difference in the anthropometric and PEFR

Keywords:
School children;
peak expiratory flow rate;
anthropometric measurement;
Union Territory of Puducherry;

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values in all the 4 regions. The PEFR of 55.3%, 14.7%, 77% and 63.5% of the children in Puducherry, Karaikal, Mahe and Yanam respectively were falling within the safe zone (Green Zone). Only in Mahe (346.77) and Yanam (305.64) PEFR value was found to be within the predicted PEFR (L/min). The highest (113.03) and lowest (41.13 L/min) difference in PEFR levels among regions substantiates the variability of PEFR with respect to region. It is concluded that mild airway obstruction among children is a major public health problem in the Union Territory of Puducherry especially in Karaikal.

1. Introduction

Puducherry is a well-known Union territory located in the southern region of India on the west coast. It comprises of four regions namely Puducherry, Karaikal, Mahe and Yanam which lie scattered in South India.Puducherry, the capital of the Territory is bounded on the east by the Bay of Bengal and on the three sides by Tamil Nadu. About 160 Kms south of Puducherry on the East Coast lies Karaikal. Mahe is situated on the Malabar Coast on the Western Ghats surrounded by Kerala at about 653 km away from Puducherry. Yanam is situated adjoining the East Godavari district of Andhra Pradesh and is about 840 km Northeast of Puducherry. This thickly populated Union Territory besides having variation in geographical distribution also exhibits a wide range of difference in environmental, socio-cultural, demographic patterns and epidemiology of respiratory diseases.

Acute respiratory infections (ARI) are a major burden to child health in developing countries like India. There are significant gaps in primary healthcare delivery and clinical approach to the management of airway diseases. Lack of awareness tends to under estimate the disease prevalence and progression[1]. The Canadian Association of Physicians for the Environment [2] says that children are particularly vulnerable to respiratory infections than adults owing to the differences in their developmental and behavioral pattern.

Estimates in 2008 had suggested that 3.5% of the global burden of disease was caused by ARI and in developing countries, on an average every child has five episodes of ARI/year accounting for 30%-50% of the total pediatric outpatient visits and 20%-30% of the pediatric admissions[3].

The Peak Expiatory Flow Rate (PEFR) which is an easily measurable and reproducible test is defined by the European Respiratory Society as the maximal flow achieved during the expiration which is delivered with maximal force, starting from the level of maximal lung inflation, following the maximal inspiration expressed in litres/min [4].PEFR has been a very useful tool in the routine monitoring of healthy as well as asthmatic children [5].

Ethnicvariations[6], physical activity, environmental conditions and altitude of dwelling, urbanization, tobacco smoking [7], and changes in age, height[8], sex and socio-economic status

are already known to affect the normal pulmonary function of children. Moreover, children of South Indian origin have shown variation in pulmonary functions when compared to children of other regions [9].

Usually PEFR zones have been a benchmark measure to assess the management of asthma in children and adults. But little is known about the PEFR zones in normal healthy children. Hence, thepresent study was carried out with the objective of comparing the airway patency of school children (10 – 14 years) in each of the 4 regions of the Union Territory of Puducherry based on PEFR zones with respect to selected anthropometric parameters.

2. Research Method

This cross sectional school based study was conducted to evaluate the PEFRof school children (10-14 years) from 4 different regions of the Union Territory of Puducherry. The study was carried out for a period of 1 year and 8 months from June 2015 to February 2017. Children of both sexes representing rural, urban and semi-urban areas were selected by stratified random sampling method from Puducherry (1187), Karaikal (327), Mahe (209) and Yanam (203). Prior permission was obtained from the Directorate of Education and thereafter from the respective schools. Written consent was taken from the parents/guardian and an ethical clearance was obtained from the Institution. Prescribed standardized tools such as stadiometer, weighing machine and non-stretchable flexi tape were used to measure the anthropometric parameters which are one of the direct methods of assessing the nutritional status of the children. Body mass index (BMI) was calculated using the formula Weight (Kg)/Height (m^2).

The PEFR was measured in a sitting position using Mini-Wright peak flow meter with disposable mouthpiece for each subject. After explaining the purpose of the study and the method of using peak flow meter by way of demonstration, 3 PEFR maneuvers were made by each subject and the highest value was noted as the actual PEFR value.

For this particular study, the variables were restricted to PEFR and anthropometric measurements (height, weight, chest circumference and BMI). At the time of assessment only healthy children were included and children with cough, cold and other respiratory illness were

excluded. The data was analyzed using SPSS 19.0version and the results are discussed with height, weight,BMIand chest circumference as independent variables and peak expiratory flow rate categorized into three zones (Red Zone, Yellow Zone and Green Zone)as dependent variable.

3. Results and Analysis

The results of the present study in accordance with the objective are presented and discussed below:

Table 1.Regional distribution of sample based on anthropometric and measurements and PEFR

Comparison between Regions using all the parameters						
Parameters	Region	Mean	Std. Deviation	N	F-value	p-value
Height (cm)	Puducherry	148.663[a]	10.217	1187	17.624	0.000*
	Karaikal	151.826[b]	9.516	327		
	Mahe	152.689[b]	9.232	209		
	Yanam	151.444[b]	8.799	203		
Weight	Puducherry	38.043[a]	10.074	1187	28.768	0.000*
	Karaikal	42.706[c]	10.436	327		
	Mahe	43.024[c]	9.724	209		
	Yanam	40.046[b]	8.411	203		
BMI	Puducherry	16.990[a]	3.172	1187	22.249	0.000*
	Karaikal	18.416[b]	3.657	327		
	Mahe	18.355[b]	3.383	209		
	Yanam	17.441[a]	3.336	203		
Chest Circumference	Puducherry	71.061[b]	8.543	1187	30.069	0.000*
	Karaikal	70.700[b]	7.933	327		
	Mahe	76.272[c]	7.731	209		
	Yanam	69.466[a]	6.561	203		

PEFR	Puducherry	281.534[b]	63.593	1187	135.903	0.000*
	Karaikal	233.639[a]	60.792	327		
	Mahe	346.770[c]	80.997	209		
	Yanam	305.640[d]	66.731	203		
Wilks' Lambda = 0.629; p-value = 0.000*						

Note: '*' represents 'significant'

Same superscript do not differ significantly and different superscripts differ significantly

Although sex is known to be one of the factors that determine PEFR of children, the present study has not attempted to segregate the sample based on sex because the aim of the study was to categorize the overall sample according to PEFR zones. Moreover, the range between the Green zone and Yellow Zone is around 30% which is high enough to take into account the difference in PEFR values with respect to age, sex, height, weight, chest circumference, BMI and location.

The anthropometric measurements and PEFR valuescompared among the respondents belonging to each of the 4 regions of the Union Territory of Puducherry namely Puducherry, Karaikal, Mahe and Yanam are represented in Table 1. From the above table it is clear that all the p-values are lesser than the comparable significance level i.e., p-value >0.05 thereby indicating a significant difference in the mean values of all the parameters in all 4 regions.

A significant difference in height was observed among the children of Yanam, Karaikal and Mahe when compared to Puducherry because the height of the children in Puducherry was found to be lower than their counterparts. The weight of the children in Mahe and Karaikal being greater than Puducherry and Yanam showed a significant difference. Between Puducherry and Yanam a significant difference was seen in the children of Yanam. A similar trend in the level of significance was observed among the children of Puducherry and Yanam with respect to BMI. Among the 4 regions, the values in BMI differed significantly among the children of Mahe and Karaikal. Based on the classification of BMI for children and adolescents given by Khadilkar et al (2012)[10] Chronic Energy Deficiency (CED) was found to be prevalent among majority of the children in the Union Territory of Puducherry with a BMI ≤ 18.5[11]. The chest circumference of the children in Puducherry and Karaikal was found to be significant when compared to Yanam.

Children of Mahe who had the highest chest circumference (76.2cms)showed statistical significance in the mean values when compared to the other 3 regions. The PEFR value was highest in Mahe (346.7 L/min) followed by Yanam (305.6 L/min), Puducherry (281.5 L/min) and Karaikal (233.6 L/min) and this result indicates a statistical difference among the 4 regions.A wide range in the PEFR values was observed among the 4 regions with the highest and lowest difference between the two regions being 113.03 L/min and 41.13 L/min respectively thereby substantiating the variability of PEFR with respect to region. Karaikal had the lowest PEFR valueand a study in 2013[12] on PEFR values in children (6-12 years) of Karaikal had reported that their values were lesser than those of other south Indian, north Indian and western children.

Overall, this study showed that only the children of Mahe and Yanam had PEFR values within the predicted PEFR (L/min) which are based on the formulae given in Lung Function by J.E Cotes Fourth Edition), adapted for EU scale Mini-Wright peak flow meters by Clement Clarke[13].

Table 2.Regional distribution of sample based on the category of PEFR Zones

Region	Green Zone (Safer Side)		Yellow Zone (Caution Side)		Red Zone (Danger Side)		Total	
	Number	%	Number	%	Number	%	Number	%
Puducherry	656.0	55.3	517.0	43.6	14.0	1.2	1187.0	100.0
Karaikal	48.0	14.7	236.0	72.2	43.0	13.1	327.0	100.0
Mahe	161.0	77.0	46.0	22.0	2.0	1.0	209.0	100.0
Yanam	129.0	63.5	70.0	34.5	4.0	2.0	203.0	100.0
Total	994.0	51.6	869.0	45.1	63.0	3.3	1926.0	100.0

The present study conducted among 1926 school children (10-14 years) in the Union Territory of Puducherry revealed that the actual PEFR value of 77%, 63.5% and 55.3% of the children in Mahe, Yanam and Puducherry respectively were above 80 % of the expected PEFR value and they were falling in the Green zone (Safer side). Only a least percentage of children in Karaikal (14.7 %) were found to be categorized in the green zone.

The highest percentage of children in the yellow zone (Caution Side) whose actual PEFR value ranged between 50 – 79% of the expected PEFR value was found to be in Karaikal (72.2%) followed by Puducherry (43.6%), Yanam (34.5%) and Mahe (22.0%). This shows that the children of Karaikal and Puducherry are at greater health risk when compared to Mahe and Yanam. The actual PEFR value was found to be below 50% of the expected PEFR value in 1.2%, 13.1%, 1% and 2% of the children belonging to Puducherry, Karaikal, Mahe and Yanam respectively and were all categorized under the Red Zone (Danger Zone). In Karaikal, the children falling in the Green zone and Red zone were almost equal with a percentage difference of only 1.6percent.

4. Conclusion

Poor lung function among the school children in the Union Territory of Puducherry (irrespective of sex and location) is a major public health problem which needs to be addressed immediately to prevent morbidity and also to reduce its severity. The findings of the present study will be an eye opener to the clinicians and policy makers. Regular screening and medical intervention in schools for lung function can help in the early detection and control of airway obstruction in children. Control of vehicular pollution especially in school zones should be made mandatory as it would to a greater extent help in curbing respiratory problem.

5. Acknowledgements

This study was funded by the Indian Council for Social Science Research (ICSSR), New Delhi

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