Exercise or Fitness as Remedy for Respiratory Problem in Delhi (India) of Growing Children of Extreme Socioeconomic Status

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Introduction

Air Pollution

Atmospheric pollution arises from heating and generation of electrical energy, transport, industrial activities and incineration of wastes. The major pollutants from the burning of fossil fuel include oxides of sulfur, smoke (suspended particulate matter) and oxides of carbon and of nitrogen. Urban transport systems emit carbon monoxide, hydrocarbons, oxides of nitrogen and lead, and small amounts of sulfur oxides and smoke. Photochemical reactions between hydrocarbons and nitric oxide result in the production of secondary air pollutants classified under the general term "oxidants". Oxidant formation is promoted by abundant sunlight. Industry emits large quantities of residuals from fossil fuel burning, but also various specific substances such as toxic metals, inorganic and organic compounds of sulfur and nitrogen, fluorides and others. In many parts of the world air pollution associated with heating and power production is still more important than that due to motor vehicles [1].

Air pollution is contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere. Household combustion devices, motor vehicles, industrial facilities and forest fires are common sources of air pollution. Pollutants of major public health concern include particulate matter, carbon monoxide, ozone, nitrogen dioxide and sulfur dioxide. Outdoor and indoor air pollution cause respiratory and other diseases, which can be fatal. Around 3 billion people cook and heat their homes using solid fuels (i.e. wood, charcoal, coal, dung, crop wastes) on open fires or traditional stoves. Such inefficient cooking and heating practices produce high levels of household (indoor) air pollution which includes a range of health damaging pollutants such as fine particles and carbon monoxide. In poorly ventilated dwellings, smoke in and around the home can exceed acceptable levels for fine particles 100-fold. Exposure is particularly high among women and young children, who spend the most time near the domestic hearth. According to WHO, 4.3 million people a year die from the exposure to household air pollution.

In new estimates released, WHO reports that in 2012 around 7 million people died, one in eight of total global deaths, as a result of air pollution exposure. This finding more than doubles previous estimates and confirms that air pollution is now the world’s largest single environmental health risk. In particular, the new data reveal a stronger link between both indoor and outdoor air pollution exposure and cardiovascular diseases, such as strokes and ischaemic heart disease, as well as between air pollution and cancer. This is in addition to air pollution’s role in the development of respiratory diseases, including acute respiratory infections and chronic obstructive pulmonary diseases. The new estimates are not only based on more knowledge about the diseases caused by air pollution, but also upon better assessment of human
Various epidemiological studies conducted in different parts of the world have conclusively established that the adverse health effects are associated with common urban air pollutants. Although several recent studies revealed the poor air quality status in Delhi, but limited evidence of the impact of criterion air pollutants on human health remains a big limitation for relevant policy changes. Researcher conducted a time series to estimate the short term effects of ambient air pollution on all-natural-cause mortality in Delhi for the period 2008 to 2010. The study examined the impact of criteria air pollutants [particulate matter less than 10 μm in diameter (PM$_{10}$), sulphur dioxide (SO$_2$), Nitrogen di-oxide (NO$_2$), Carbon monoxide (CO) and Ozone (O$_3$)] on daily all-cause-mortality rate. A semi-parametric regression model was developed to estimate the short term effects of air pollutants on daily all-natural-cause-mortality adjusting nonlinear confounding of time, temperature and relative humidity. A significant association of all-natural-cause mortality in association with short-term exposure to particulate as well as the gaseous pollutants were observed. The study estimated 0.14% (95% CI 0.02%–0.26%) increase in all-cause-mortality for every 10 μg/m$^3$ increase in PM$_{10}$ concentration. Among the gaseous pollutants, NO$_2$ has been found to show most significant positive association of 1.00% (95% CI 0.07%–1.93%) increase in all-cause-mortality with every 10 μg/m$^3$ increase in daily NO$_2$ concentration. The effect of O$_3$ and CO has been observed to be significant after controlling the effects of NO$_2$. Analysis by different age groups reveals that particulate matter has maximum effect estimate in the age group ≥65 years (RR 1.002, 95% CI 1.000 to 1.004) whereas gaseous pollutants have been found to exhibit maximum effect estimate (RR 1.016, 95% CI 1.002 to 1.030) in the age group 5–44 years. The results of the present effect estimates appeared consistent with previous findings and can enhance the strength of the previous evidences to understand health burden associated with local air quality [2].

**Statistic of Respiratory Problem in Delhi**

Chronic respiratory diseases affect the airways and other structures of the lung with chronic obstructive pulmonary disease (COPD) and bronchial asthma being the most common types of these diseases [4]. Chronic respiratory diseases remain an important cause of disability and health care burden both globally and in India. The global burden of these diseases is showing a discernible upward trend, and an estimated 500 million people suffer from them [5].

COPD happens to be the fourth leading cause of death and 13th leading cause of burden of diseases worldwide with an increase projected over the next decade [6].

COPD has classified been classified “a disease state characterized by airflow limitation that is not fully reversible” by the global initiative for chronic obstructive lung disease. The limitation is usually both progressive and associated with an abnormal inflammatory response of the lungs to noxious particles or gasses [7].

In India, COPD remains a major public health problem requiring management from the primary health care level onward [8]. In India, 65 million suffer from respiratory diseases of noncommunicable type, out of which asthma and COPD account for 42 million cases, and this figure is likely to grow by 20% by 2030 [9].

The combined prevalence of chronic bronchitis, bronchial asthma, and COPD was found to be 8.77%. Individually, the prevalence of chronic bronchitis, bronchial asthma, and COPD was found to be 3.36%, 1.18%, and 4.21%, respectively which is in conformity some previous studies. However, one need to recognize that prevalence estimates in COPD may not be totally accurate. Epidemiological studies in past have tried to address the prevalence of COPD in India with the limiting issue being the methodology adopted and the definitions employed for diagnosis. Majority of the studies have used an unvalidated questionnaire based methodologies with or without measurement of peak flows. The reported prevalence estimates have ranged from 2% to 22% in men and from 1.2% to 19% in women [10].

Recently, “Indian Study of Asthma, Respiratory Symptoms and Chronic Bronchitis” study of 85,105 men and 84,470 women from 12 urban and 11 rural sites reported a prevalence of chronic bronchitis to be 3.49% (4.29% in males and 2.7% in females) in adults ≥35 years [11]. The national burden was thus estimated to be 14.84 million. However, since the study was questionnaire-based and spirometry poorly correlates with symptoms, this study might have missed asymptomatic individuals with exposure to air pollutants through the use of improved measurements and technology. This has enabled scientists to make a more detailed analysis of health risks from a wider demographic spread that now includes rural as well as urban areas. Regionally, low- and middle-income countries in the WHO South-East Asia and Western Pacific Regions had the largest air pollution-related burden in 2012, with a total of 3.3 million deaths linked to indoor air pollution and 2.6 million deaths related to outdoor air pollution [2].

Statistical displays of respiratory health outcomes showed most significant positive association of 1.00% (95% CI 0.002–0.07%) increase in all-cause-mortality with short-term exposure to particulate as well as the gaseous pollutants were observed. The study estimated 0.14% (95% CI 0.02%–0.26%) increase in all-cause-mortality for every 10 μg/m$^3$ increase in PM$_{10}$ concentration. Among the gaseous pollutants, NO$_2$ has been found to show most significant positive association of 1.00% (95% CI 0.07%–1.93%) increase in all-cause-mortality with every 10 μg/m$^3$ increase in daily NO$_2$ concentration. The effect of O$_3$ and CO has been observed to be significant after controlling the effects of NO$_2$. Analysis by different age groups reveals that particulate matter has maximum effect estimate in the age group ≥65 years (RR 1.002, 95% CI 1.000 to 1.004) whereas gaseous pollutants have been found to exhibit maximum effect estimate (RR 1.016, 95% CI 1.002 to 1.030) in the age group 5–44 years. The results of the present effect estimates appeared consistent with previous findings and can enhance the strength of the previous evidences to understand health burden associated with local air quality [2].
significant spirometric abnormalities. An investigation from Pune on COPD prevalence using postbronchodilator spirometry in addition to the questionnaire reported a nearly 2-fold higher prevalence [12]. A collaborative study with burden of lung disease (BOLD) investigators using BOLD protocol, the prevalence of Stage 1 or higher COPD in participants >40 years of age based in rural Kashmir was found to be 19.3% [13].

A higher prevalence can be attributed probably to nonuse of cleaner fuels in the domestic kitchens, a common practice in rural kitchens of North India. In contrast, a lower prevalence of 3.3% was reported from a rural area of South India probably pointing to a North-South divide in prevalence [14]. There appears to be rural-urban divide as well with Urban Kashmir reporting a prevalence of 5.7% prevalence for chronic bronchitis. Similar to this a lower prevalence was has been reported by Chhabra et al. in a study in New Delhi [15].

The results of this study showed that chronic bronchitis and COPD increased with advancing age, and it concurs [16]. It is mostly attributed to changes in immune system and negative impact of age on lung physiology. In contrast, there was absence of any association between chronic bronchitis and increasing age in a study conducted in Pune slums [18]. Both chronic bronchitis and COPD have shown a male preponderance in the current study and it could be best explained by differential rates of smoking and occupational exposures between the two genders. However, Pandey in a rural study in Nepal reported contrasting results with higher prevalence of chronic bronchitis in females, and it was attributed to domestic smoke pollution [19]. Hence, air pollution and lungs problems are highly coordinated. Globally, ambient particulate air pollution was the ninth leading cause of premature deaths, and most of the disease attributable to exposure to ambient particulate air pollution is cardiovascular disease. Short-term and long-term exposures to outdoor particulate matter pollution are associated with a range of adverse cardiovascular health effects such as heart rate variability, development of atherosclerosis, myocardial ischemia, myocardial infarction, stroke, and deaths [20]. Despite this, there is not the same recognition of particulate air pollution as an important risk factor for cardiovascular disease morbidity and mortality compared to the more established risk factors such as cigarette smoking and hypertension. It is now time to reevaluate the contribution of particulate air pollution to cardiovascular disease [21].

The health benefits of exercise are well known. Many of the most accessible forms of exercise, such as walking, cycling, and running often occur outdoors. This means that exercising outdoors may increase exposure to urban air pollution. Regular exercise plays a key role in improving some of the physiologic mechanisms and health outcomes that air pollution exposure may exacerbate. This problem presents an interesting challenge of balancing the beneficial effects of exercise along with the detrimental effects of air pollution upon health.

**Growth and Development and Lung Function**

The developing lung is highly susceptible to damage from exposure to environmental toxicants particularly due to the protracted maturation of the respiratory system. The functional organization of the lungs requires a coordinated ontogeny of critical developmental processes that include branching morphogenesis, cellular differentiation and proliferation, alveolarization, and maturation of the pulmonary immune, vasculature, and neural systems. Therefore, exposure to environmental pollutants during crucial periods of prenatal and/or postnatal development may determine the course of lung morphogenesis and maturation. Depending on the timing of exposure and pathobiological response of the affected tissue, exposure to environmental pollutants can potentially result in long-term alterations that affect the structure and function of the respiratory system. Besides an immature respiratory system at birth, children possess unique differences in their physiology and behavioral characteristics compared to adults that are believed to augment the vulnerability of their developing lungs to perturbations by environmental toxins. Furthermore, an interaction between genetic predisposition and increased opportunity for exposure to chemical and infectious disease increase the hazards and risks for infants and children. In this article, the evidence for perturbations of lung developmental processes by key ambient pollutants (environmental tobacco smoke [ETS], ozone, and particulate matter [PM]) are discussed in terms of biological factors that are intrinsic to infants and children and that influence exposure-related lung development and respiratory outcomes [22].

In the last two decades, 5 cohort studies have been initiated to examine the association of infant respiratory function with genetic and environmental risk factors, as well as with subsequent lower respiratory illness in early childhood. While the current complexity of respiratory function tests in this age group precludes study samples with sufficient power to examine more complex issues, information from these studies has provided an
exciting adjunct to that available from the larger cohort studies. Premorbid alterations in airway function or lung development increase the risk of wheezing lower respiratory illnesses during the preschool years and the risk of impaired airway function at 5-6 years of age. In addition, gender differences in airway function and the response to maternal smoking have been observed. Larger collaborative population-based studies are needed to explore the environmental, genetic and immunological mechanisms responsible, but will depend on the development of less invasive tests of airway function appropriate for use in healthy infants [23].

Exercise is an important component of pulmonary rehabilitation for patients with chronic lung disease. To explore the role of physical activity in maintaining cardiac and respiratory function in healthy people. Cardiorespiratory fitness was measured by a maximal treadmill test (MTT), and respiratory function was tested by spirometry. The cross sectional study included data from 24 536 healthy persons who were examined at the Cooper Clinic between 1971 and 1995; the longitudinal study included data from 5707 healthy persons who had an initial visit between 1971 and 1995 and a subsequent visit during the next five years. All participants were aged 25-55 years and completed a cardiorespiratory test and a medical questionnaire. In the cross sectional study, after controlling for covariates, being active and not being a recent smoker were associated with better cardiorespiratory fitness and respiratory function in both men and women. In the follow up study, persons who remained or became active had better MTT than persons who remained or became sedentary. Men who remained active had higher forced expiratory volume in one second (FEV1) and forced vital capacity (FVC) than the other groups. Smoking was related to lower cardiorespiratory fitness and respiratory function. Physical activity and non-smoking or smoking cessation is associated with maintenance of cardiorespiratory fitness. Change in physical activity habits is associated with change in cardiorespiratory fitness, but respiratory function contributed little to this association during a five year follow up [24].

Regular exercise has proved to be beneficial for the human body and the lungs are no exception. The study was undertaken to assess the relation between the quality of exercise performed and the quantitative effect of these exercises on the lungs. Pulmonary function tests of sportsmen engaged in various sports were compared with each other and with that of the controls. Players playing football (n=18), hockey (n=19), volleyball (n=20), swimming (n=20) and basketball (n=18) were chosen for this study. Medical students (n=20) were chosen as controls. The parameters taken into account in this study were forced vital capacity (FVC), forced expiratory volume (FEV1), and peak expiratory flow rate (PEFR). The results indicate that all the sportspersons had a higher values of lung functions compared to the controls. Among the various groups of players chosen for this study, the swimmers showed the maximum increase in their lung functions [25].

A cohort of 1,678 Southern California children, enrolled as fourth graders in 1996, was followed for 4 years to determine whether the growth in lung function of the children was associated with their exposure to ambient air pollutants. These subjects comprised the second cohort of fourth grade children participating in the Children's Health Study. Significant deficits in lung function growth rate were associated with exposure to acid vapor, NO2, particles with aerodynamic diameter less than 2.5 μm (PM2.5), and elemental carbon. For example, the average annual growth rates of maximal midexpiratory flow and forced expiratory volume in 1 second were reduced by approximately 11% (p = 0.005) and 5% (p = 0.03), respectively, across the observed range of acid exposure. Exposure to acid vapor was also associated with reductions in the ratio of maximal midexpiratory flow to forced vital capacity (p = 0.02), whereas exposure to ozone was correlated with reduced growth in peak flow rate (p = 0.006). Larger deficits in lung function growth rate were observed in children who reported spending more time outdoors. These findings provide important replication of our previous findings of an effect of air pollution on lung function growth that were based on the first fourth-grade cohort from the Children's Health Study [26].

**Social Economic Status**

To understand the living standard social economic status is the criterion measure. It is hypothesised that socio-economic status influencing the living conditions and health. For Example: In Delhi Living in Jhuggi jhopdi & lower level colonies peoples are highly exposed to pollution including air pollution. Whereas, people with higher and middle socio-economical status living in the kothis, societies having better indoor and outdoor environment those less pollution.

SES is consistently associated with health outcomes, yet little is known about the psychosocial and behavioral mechanisms that might explain this association. Researchers usually control for SES rather than examine
it. When it is studied, only effects of lower, poverty-level SES are generally examined. However, there is evidence of a graded association with health at all levels of SES, an observation that requires new thought about domains through which SES may exert its health effects. Variables are highlighted that show a graded relationship with both SES and health to provide examples of possible pathways between SES and health end points. Examples are also given of new analytic approaches that can better illuminate the complexities of the SES-health gradients [27].

Future Research

Above evidence documented research gap in regard to socio economical status, fitness level and lung function in the term of following need to be answered:

1. Does there any relation exists between socio economic status and lung function?

2. Does there any relationship exists between fitness and lung function?

3. Does there any relation exists between socio economical status boys and girls in regard to lung function?

Essence of Review and Conclusion

The trend of increasing pollution is alarming as health hazard in Delhi.

Statistics show that low and middle-income countries in the South-East Asia and Western Pacific Regions had the largest air pollution-related burden in 2012, with high deaths related to outdoor air pollution.

According to Who, 4.3 million people a year die from exposure to household air pollution.

In India, 65 million suffer from respiratory diseases of non communicable type, out of which asthma and COPD account for 42 million cases, and this figure is likely to grow by 20% by 2030.

Larger deficits in lung function growth rate were observed in children who reported spending more time outdoors.

Air pollution causes many respiratory fatal diseases like acute respiratory infection and chronic obstructive pulmonary diseases (COPD).

Studies from different part of world has showed that adverse health effect are associated with common urban air pollution.

Statistic of the world suggest that 500 million people suffered from chronic respiratory diseases.

COPD happens to be the fourth leading cause of death and 13th leading cause of burden of diseases worldwide.

Studies shows that Smoking was related to lower cardiorespiratory fitness and respiratory function.

chronic bronchitis and COPD increased with advancing age. It is mostly attributed to changes in immune system and negative impact of age of lung physiology.

Air pollution and lungs problems are highly coordinated. Globally, ambient particulate air pollution was the ninth leading cause of premature deaths, and most of the disease attributable to exposure to ambient particulate air pollution is cardiovascular disease.

Short-term and long-term exposures to outdoor particulate matter pollution are associated with a range of adverse cardiovascular health effects such as heart rate variability, development of atherosclerosis, myocardial ischemia, myocardial infarction, stroke, and deaths. Despite this, there is not the same recognition of particulate air pollution as an important risk factor for cardiovascular disease morbidity and mortality compared to the more established risk factors such as cigarette smoking and hypertension.

Exercise is an important component of pulmonary rehabilitation for patients with chronic lung disease.

Physical activity maintains cardiac and respiratory functions in healthy people.

Studies show that Men who remained active had higher forced expiratory volume in one second (FEV1) and forced vital capacity (FVC) than the other non active Men ,hence active Man has good respiratory function than non active Men.

Regular physical exercise increases the lung function capacity for individual for better health.
• The socio-economic status has correlation between lung function of individual (rich people having better lung function as compared to poor people).

References


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