Research Article

Assessment of pulmonary functions in seafarers

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Abstract

Background: Aerosol inhalation has been shown to have deleterious effects on the respiratory system. Seafarers those who are working on the upper deck of the ship are continuously exposed to sea salt aerosol. Performing spirometry can detect and quantify respiratory system abnormalities by the use of various parameters of pulmonary function tests.

Objective: To assess the effect of chronic exposure and inhalation of sea salt aerosol on pulmonary functions in seafarers.

Materials and Methods: This study was carried out in 40 nonsmoking, healthy seafarers aged between 30 and 40 years who were working in the top deck of a ship for more than 10 years. Pulmonary functions such as forced expiratory volume (FEV1), forced vital capacity (FVC), FEV1/FVC, peak expiratory flow (PEF), and maximum midexpiratory flow (FEF 25%–75%) were assessed. Data were analyzed by Student's *t* test using SPSS 17.0, and *p* value <0.05 was considered significant.

Results: No significant changes were observed between the control and seafarers in all the parameters studied: FVC ($p = 0.06$), FEV1 ($p = 0.39$), FEV1/FVC ($p = 0.06$), PEF ($p = 0.33$), and FEF 25%–75% ($p = 0.14$).

Conclusion: No significant change was noticed in the pulmonary functions in the seafarers. They seem to be quite normal compared with the control individuals. The reason for this may be because inhalation of the sea salt aerosol containing sodium chloride would have aided in the stabilizing of the alveoli.

KEY WORDS: Sea salt aerosol, lungs, pulmonary functions

Introduction

An aerosol is a colloid of fine solid particle or lipid droplet in air or gas. Aerosols occur naturally, originating from volcanoes, dust storms, forest, grassland fires, living vegetation, and sea spray. Humans also contribute for the generation of particulate aerosols. A proper environmental air without much alteration in its composition is must for the proper functioning of the lungs. Individuals respiring air containing increased quantity of aerosols are more prone for pulmonary dysfunctions. Inhalation of different types of aerosols has also been reported to produce adverse effects on lungs.[1–3]

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Sea salt aerosol is originally formed from sea spray and one of the most widely distributed forms of natural aerosols. Aerosol particles formed directly from the surface of the sea by ejection into the atmosphere by bursting bubbles at the air–sea interface are called as sea spray.[4] The main composition for sea salt aerosol includes sodium chloride, organic matter, and other ions commonly present in the sea water such as K^+, Mg^{2+}, Ca^{2+}, and $SO4^{2-}$.[5]

Seafaring is one of the most risky professions, second to commercial fishermen. Half-a-million seafarers are at a constant uncertain health scenario, with life and limb always at stake. Because seafarers are working in the upper deck of the ship, they are in continuous contact with the sea salt aerosol. This study was put forward to assess the pulmonary function in seafarers.

Materials and Methods

After obtaining institutional ethical clearance and written informed consent, individuals were selected for the study.

Table 1: Pulmonary functions in seafarers

Parameters	Controls (40)	Seafarers (40)
FVC (L)	3.7 ± 0.6	3.3 ± 0.84
FEV1 (L)	3.4 ± 0.5	2.93 ± 0.43
FEV1/FVC	0.92 ± 0.07	0.84 ± 0.05
PEF (L/s)	6.76 ± 2.14	6.58 ± 2.54
FEF 25–75 (L/s)	4.18 ± 0.14	3.82 ± 0.96

Complete history was recorded, and anthropometric measurements were taken from all individuals before the commencement of the procedure. Individuals were explained about the aim, objective, nature, and noninvasiveness of the test. General examination and examination of the respiratory system were done before the experiment. Best of the individual parameters from three recordings were taken for data analysis.

The study group was divided into two groups: group I, 40 nonsmoking healthy individuals aged 30–40 years, residing away from sea shore; and group II, 40 nonsmoking, healthy seafarers aged 30–40 years who were working in the top deck of the ship for more than 10 years. Individuals who had family history of asthma and cardiovascular disorders were excluded from the study. Pulmonary functions such as forced expiratory volume (FEV1), forced vital capacity (FVC), FEV1/FVC, peak expiratory flow (PEF), and maximum midexpiratory flow (FEF 25%–75%) were assessed by using computerized spirometer "EASY ONE," Switzerland. Data were analyzed by Student's *t* test using SPSS 17.0, and *p* value <0.05 was considered significant.

Results

Data are expressed as mean ± SD in Table 1. No statistical significant changes were observed between the control and seafarers in all the parameters studied: FVC ($p = 0.06$), FEV1 ($p = 0.39$), FEV1/FVC ($p = 0.06$), PEF ($p = 0.33$), and FEF 25%–75% ($p = 0.14$).

Discussion

Epidemiological research has shown that aerosols pose a huge impact on human health. In this study, no significant change was observed in the pulmonary functions between the controls and seafarers (inhaling sea salt aerosol) in all the parameters studied. The ancient traditional Hindu science of health and medicine, Ayurveda, recommends the washing of nasal cavities daily with saline water. This practice has been used by Yogis for preparation of extended meditations and Yoga practices to ensure clean and open airways for easy breathing. The healing properties of salt therapy as a complementary treatment for a wide range of breathing conditions.[6] Because no change in the pulmonary function was observed in the seafarers who were working on the upper deck of the ship, it could have been because of the beneficial effect of the sodium chloride present in the inhaled air. Moreover, sodium chloride, which is the major constituent of sea salt aerosol, has been shown to have bactericidal and bacteriostatic effect on respiratory passage.[7,8] Because sodium chloride has a considerable negative charge of particles and the inner surfaces of airways have slight positive charge, therefore, salt aerosol particles penetrate into the lumen of respiratory tract and embed intensively.[9] In addition, the negative electrostatic charge of salt aerosol increases the lumen's stability. Negative ions have also been shown to have revive and speedup cilia beat.[10] An increase in the respiratory volume has been demonstrated in individuals undergoing salt inhalation therapy. There was also an increase in the percentage of subjects with excellent respiratory index and improved breathing mechanics.[11] Owing to its electrochemical properties, salt and saline ions, when deposed on the respiratory tract, not only result in eliminating bacteria and other microorganisms but also aid in determining the emollition, liquefaction, and fluidization of the mucus off the airways, which remove the foreign matters present in the cilia within the microcavities of the respiratory tract, thereby determining the progressive and long-term relief of breathing, the natural and easy expectoration, and the elimination of allergen or bacterial matters through the reflex phenomena of coughing and nose secretions.[11]

Conclusion

No significant change was noticed in the pulmonary functions in the seafarers. They seem to be quite normal compared with the control individuals. However, further studies are planned to explore the mechanism of action of this sea salt aerosol on the respiratory tract. This may be achieved by increasing the sample size and evaluating the pulmonary functions in individuals working in the lower deck of the ship.

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