Biomedical & Pharmacology Journal Vol. **9**(2), 659-662(2016)

The Effects of Air Pollution on the Salivary IgA Levels in Children

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http://dx.doi.org/10.13005/bpj/987

(Received: May 10, 2016; accepted: July 01, 2016)

ABSTRACT

The effects of air pollution on the human health and morbidity and mortality are well demonstrated. Air pollution affects immune system and may have effect on immunoglobulins. In this study we aim to evaluated the effects of air pollution on the salivary IgA levels in children. In this descriptive study, 44 children from Tabriz industrial city (polluted city) and 44 children from Kaleibar city (a Tabriz suburban area) with similar socioeconomic status were selected. Saliva samples were taken and salivary IgA levels were compared between groups. All statistical tests were performed using SPSS for windows Version 21. Independent t test was used to compare quantitative data between groups(P-Value=0.001). The mean levels of the salivary IgA in Tabriz city was significantly lower than was significantly lower than Kaleibar (9.73±1.57 vs. 12.25±4.4 mg/dl, p=0.001). Similar to the literature, we observed that that the salivary IgA levels are decreased in areas with air pollutions.

Key words: Air pollution; Saliva; Immunoglobulin A.

INTRODUCTION

Rapid uncontrolled growth of the cities along with increased energy consumption has caused multiple health and environmental problems. Air pollution has become a major risk factor caused by these developments[1]. Previous studies have shown the effects of air pollution on the human health and linked air pollution to morbidity and mortality[2-4]. Associations between air pollution and prevalence of respiratory symptoms such as cough and wheeze, reduced lung function and chronic bronchitis are also reported[4,5]. There are some evidences indicating pollution-induced pulmonary and systemic oxidative stress and inflammation[1] which can trigger body immune system.

Immunoglobulins (Igs) are protein molecules produced by immune system with known antibody activity[6]. They bind to antigen molecules and target bound molecules, such as toxins and constituents of micro-organisms and parasites, for inactivation and/or elimination from the organism[7]. Five distinct classes of immunoglobulin molecules are recognized namely IgG, IgA, IgM, IgD, and IgE[8] IgA and IgG have protective effects. IgGs provide protection against toxins and viruses, while IgAs protect the organism against local infections[8,9].

Secretory IgA constitutes the predominant immunoglobulin isotype in secretions, including saliva, where they protect the oral cavity[6,7]. Serving as the primary nonspecific immunity barrier, IgA contributes to innate immunity and antimicrobial

activity[10]. IgA is the biggest immunologic component of saliva which is capable of neutralizing the viruses, bacteria and toxins. It inhibits microorganisms' binding to the oral mucosa by binding their surface[11].

Environmental and systemic changes may affect the IgA concentration. It is reported that IgA levels are reduced in smokers, lead contamination and some disease like Sjogren's syndrome[8,12,13]. Due to the adverse effects of air pollution on health and considering the immunologic role of IgA, it is possible that air pollution may cause changes in salivary IgA secretion levels. The air pollution mainly due to the high vehicle traffic could disastrously affect the citizens' health. In this study we aim to evaluate the salivary IgA levels of children in two northwestern areas of Iran with different degrees of air pollution.

MATERIALS AND METHODS

In this case control study, children between 8-10 years old residing in Tabriz and Kaleibar cities with similar socioeconomic status and sex(girl) and different air pollution levels were recruited. Forty four children from each city were included. In order to select a random sample of children of each city, first, several schools were randomly selected in each region. Then, in each school, the samples were selected proportionate to the student numbers. Children who resided in the area for at least one year and use the urban gas facilities for heating and cooking applications at home were included. The children who were actively/passively exposed to tobacco smoke or with active oral infections such as periodontal disease, abscess or systemic diseases like immunosuppressive, autoimmune or diabetes diseases were excluded. The study was approved by the ethics committee of Tabriz University of Medical Sciences, and the informed consent was obtained from parents of the children.

Environmental experts of East Azerbaijan measured the amounts of pollutants (O_3, NO_2, CO, SO_2 gases) for four months (from February 2014 to May 2014) in two study areas. The amounts of the air pollutants in Tabriz were much higher than the Kaleibar. The amounts of air pollutants in Kaleibar were in the very low undetectable levels by the relevant measurement device.

In this study, the spitting method was used for saliva collecting. Saliva was collected at 9-10 AM. The participants were asked not to eat any foods within 90 minutes before the experiment. After saliva collecting, the samples were sent to the laboratory and the IgA protein levels per volume unit of each sample were assayed and recorded by ELISA method and the specific kit.

Statistical analysis

All statistical tests were performed using SPSS for windows Version 21. Quantitative data were presented as mean ± standard deviation (SD), while qualitative data were demonstrated as frequency and percent (%). Independent t test was used to compare quantitative data between groups. A p value of <0.05 was considered statistically significant.

RESULTS

Each group consisted of 44 girls. There was no difference between age of children in Tabriz and Kaleibar (9.11±0.75 vs. 9.00±0.82, p=0.51).

The mean levels of the salivary IgA in Tabriz 9.73±1.57 mg/dl was significantly lower than salivary IgA levels in Kaleibar (12.25±4.4 mg/dl, p=0.001).

Table 1: The mean and standard deviation of salivary Ig A in studied groups

P value	Maximum	Minimum	Mean(±standard deviation)	Groups
0/001	24.5 mg/dl	7.2 mg/dl	mg/dl(12.25(±4.4	kaleibar
0/001	12.1 mg/dl	5.7 mg/dl	1.57)mg/dl ±)9.73	Tabriz

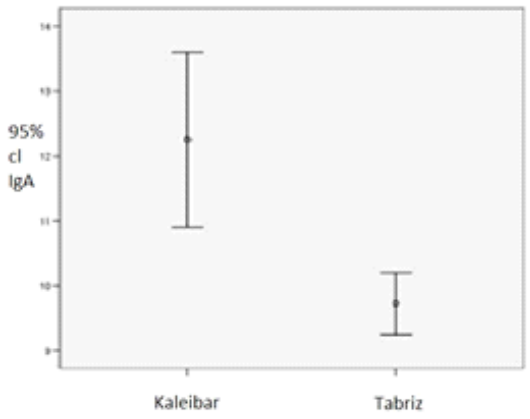

Fig: 1: Error bar of salivary IgA levels in groups

DISCUSSION

In this study we evaluated the salivary IgA levels of children from two cities with different air pollution rate. The children of the Tabriz industrial city had significantly lower salivary IgA compared to Kaleibar.

Similarly, Marth et al investigated fifty 10 years old boys in Cairo and observed that the air pollution reduces IgA secretion in saliva, causing obstructive pulmonary disorder[14]. In a study on the Chinese children, Chen et al surveyed the effects of outdoor/indoor air pollutions on the immunity and secretion status of the lysosomal salivary proteins and IgA. The results indicated that air pollution can reduce hildren's immunity. In addition, indoor air pollution (using of cooking coal) more negatively affects their health than the outdoor one[15].

In another study, Wagner and colleagues[16] reported similar differences between polluted and non-polluted areas, but mentioned that salivary IgA compared to serum Immunoglobulins were less able to demonstrate these variations. Other studies could not detect any difference between polluted and non-polluted areas. However, Anotva[17] observed increased levels of IgG, IgM and IgA in population of polluted cities. Ruiz and colleagues[18] also did not find any differences in serum Igs and salivary IgA. It is possible that this difference could be due to differences in severity of air pollution and the rate of pollutants in each area in different studies. However, due to the effect of pollution on the immune systems, the changes in the immunoglobulins, especially the immunoglobulin profile of saliva are expected. Wagner and colleagues[19] also found significant associations between the contaminant concentrations in air and levels of blood and saliva proteins including IgA and suggested that quality of air may have considerable impacts on defense mechanisms. Given the basic contribution of the salivary IgA in innate immunity, neutralizing the microorganisms' activities and inhibiting their binding to the oral mucosa, its reduced levels due to air pollution can increase the incidence of caries and other mucosal lesions. It is reported that levels of salivary IgA in children without dental caries are higher than the children with active caries[20].

CONCLUSION

These results indicate that the pollutants generated from heavy vehicle traffic can lead in reduced salivary IgA levels in children. As the reduced IgA may lead in some oral and dental disease, it's recommended to evaluate children in polluted areas and if necessary refer them to specialists.

ACKNOWLEDGMENTS

We appreciate the research department of Tabriz dentistry faculty for funding this project.

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