

## Association of smoking and IgE levels among smoker women in Khartoum

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### Abstract

**Objective:** this study was carried out to investigate the effects of cigarettes and shisha smoking on serum IgE levels among smoker women in Khartoum.

**Methods:** 62 sera were counseled for socio-demographic and allergic reactions risk, and screened for complete blood count by Sysmex machine and total IgE antibody levels by enzyme linked immunoassay (ELISA).

**Results:** 43% of smoker women had an increased total IgE levels compared to non-smoker ones and this is more clear among those who smokes shisha rather than cigarettes. CBC showed non- significant increase in the blood indices of smoker women.

**Conclusion:** smoking may increase the risk of developing allergic responses and atopic diseases and in particularly among shisha smokers.

{**Citation:** Rasha El-Bushra Abdulhamid, Abdalla Hassan Sharief, Samia Ali Omer. Association of smoking and IgE levels among smoker women in Khartoum. American Journal of Research Communication, 2015, 3(11): 48-54} [www.usa-journals.com](http://www.usa-journals.com), ISSN: 2325-4076.

### Introduction

Tobacco smoking is associated with a variety of alterations in the humoral immune system function. This includes the effects of smoking on serum concentrations of the immunoglobulin's isotypes. However, the levels of theses immunoglobulins provide a key information on the humoral immune status (Dinas *et al.*, 2013; Moustafa and El-elemi, 2013; Al-Bayatte and Shnawa, 2014). It has been reported by Nagasak and Matsumoto, (2013) that adult levels of IgE are elevated in smokers compared with non-smokers which indicate that smokers are more prone to develop allergic responses. Jensen *et al.*, (1992) observed that this effect seems to be more common in males than in females and there is a dose-response relationship in the sense that increased pack-years correlate with increased IgE levels.

Jenesen *et al.*, (1992) also reported that nicotine is the main psychoactive ingredient in cigarettes smoke and shisha that increases mucosal permeability allowing easier and greater access of allergens to subepithelial lymphoid tissue. The mucosal theory of atopy proposes that increased permeability to antigenic materials may enhance atopy has also been confirmed (Barbour *et al.*, 1997; Chhabra *et al.*, 2001).

Cigarettes smoke contains more than 45,000 chemicals which have various toxic, mutagenic and carcinogenic effects in which the contents and concentrations of chemical ingredients can vary widely in the different cigarettes brands (Luther, 2007; Richter *et al.*, 2008; Fowles and Dybing, 2013). The major components of cigarettes smoke that lead to many of the deleterious and toxic effects includes nicotine, tar, ammonia, carbon monoxide, carbon dioxide, formaldehyde, acrolein, acetone, benzopyrenes, hydroxyquinone, nitrogen oxides and cadmium (Lukeoppa, 2013; Fkppi, 2010). Although it is thought that shisha smoking has fewer health risks than smoking cigarettes, Wasim, (2009) and Barnett *et al.*, (2011) stated that it is a major misconception in due to various toxic ingredients which have shown that shisha smoking is far more dangerous and even after passing through water it still contains high levels of toxic compounds, including carbon monoxide, heavy metals and cancer-causing chemicals (carcinogens). Djordjevic *et al.*, (1999) discovered that each cigarette stub contains approximately 1.2 mg of nicotine but the smoker will absorb around 0.1 mg of nicotine from it. Whereas, Hadidi and Mohammed (2004) revealed that a single session of shisha smoking which takes up approximately 45 minutes to 1 hour, yields nicotine intake as much smoke as a cigarettes smoker would inhale consuming 100 or more cigarettes.

It has been suggested that tobacco smoking cause acute inflammatory reactions characterized by accumulation of neutrophils, macrophages and lymphocytes in the membranous bronchioles and alveoli of the lungs in which activated macrophages secretes many inflammatory proteins that may enhance the inflammatory process. Thus smoking may change blood profile altering the complete blood count and causes elevation in peripheral white blood cells count, erythrocytes, platelets and hemoglobin levels (Arcavil *et al.*, 2004; Sopori, 2002; Velazquez *et al.*, 2013).

## Materials and methods

### Data collection

#### Samples

Sixty two consented females (mean age  $27.6 \pm 5.9$  years) were enrolled and history of smoking and associated allergic illnesses was obtained. 32 samples (blood and filter paper finger pricks) were collected from those who use cigarettes, water pipe (shisha) and/or both. Sera were obtained from 12 blood samples by centrifugation at 1500 rpm for 5 minutes. 20 finger prick blood spots were collected onto No. 3 Whatman filter paper. Another 30 age-matched nonsmoking women were also included for control purposes.

#### Analysis of blood profile

Complete blood count (CBC) analysis was performed using Sysmex automated Hematology Analyzer. Blood samples were automatically examined and all values were displayed and printed for review.

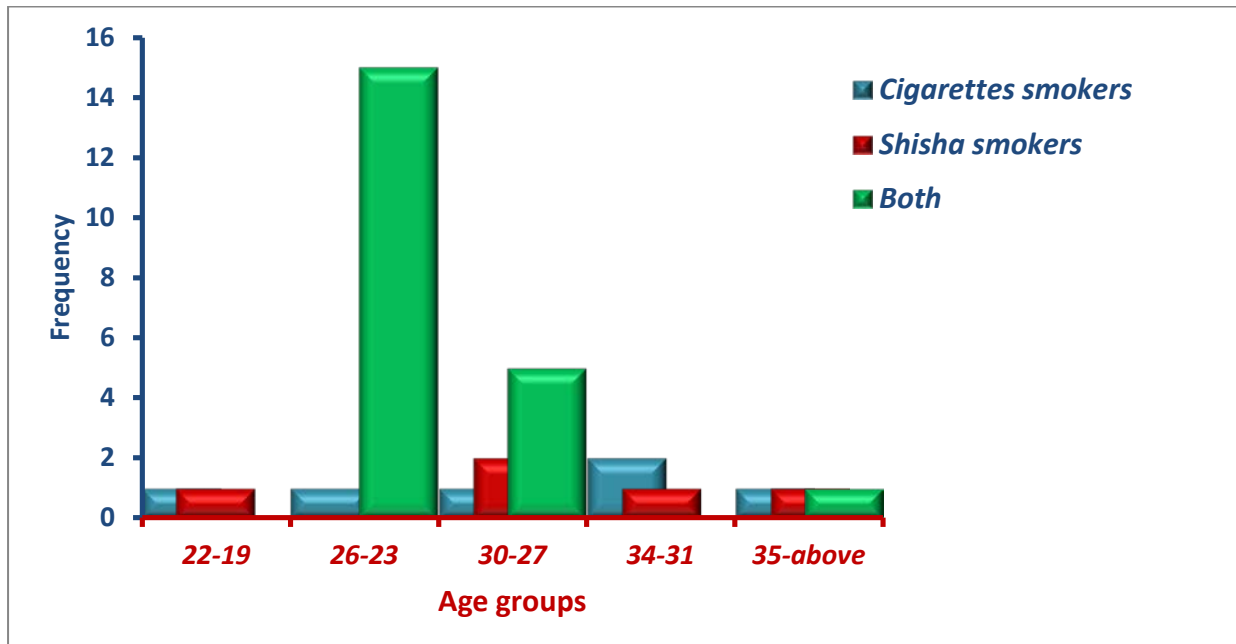
#### Total IgE levels determination

IgE levels were assessed using a commercially-purchased ELISA kit (Euro-immune, Germany), and the test was performed according to manufactured instructions. For filter

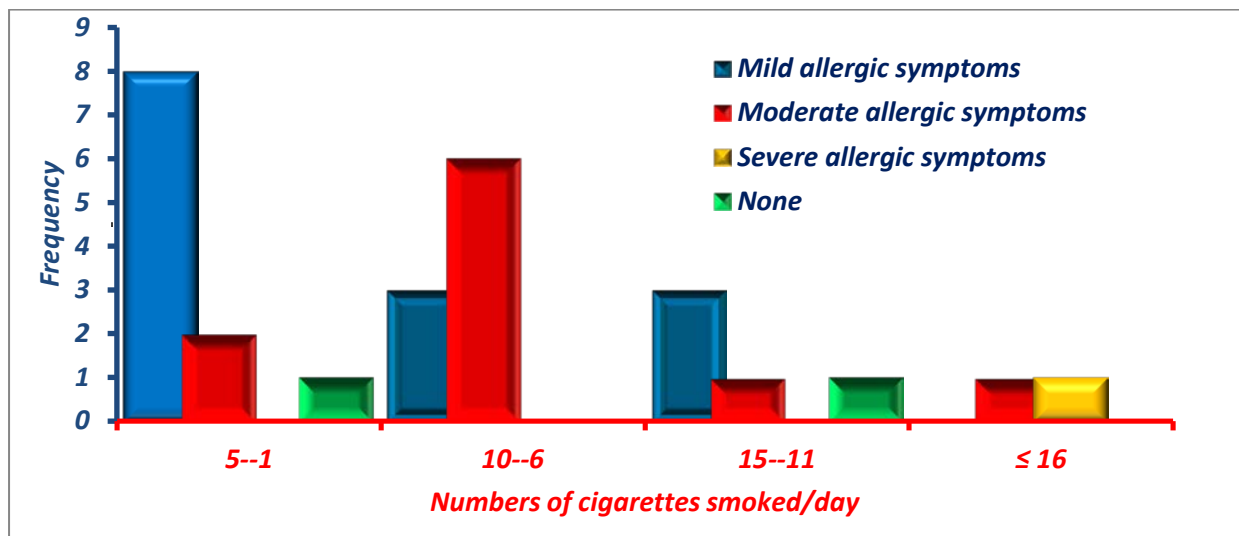
paper blood, discs corresponding to 5  $\mu$ l of blood were punched out (using paper puncher) of the filter papers and transferred into vials containing 0.9% normal saline overnight. All samples (sera and blood discs) were diluted 1:300 before being subjected for IgE screening. 100  $\mu$ l of diluted serum were added and the plate was incubated at room temperature for 30 minutes. Each step included removal of plate contents and washing followed by gentle stoking of the plate on absorbent paper to remove air bubbles. Next 100  $\mu$ l of enzyme conjugate reagent was dispensed into each well and incubated at room temperature for 1 hour. 100  $\mu$ l of TMB substrate was added before incubation for 30 minutes. The reaction was stopped by adding 100  $\mu$ l of stop solution (1N HCl) into each well. The optical density was read using ELISA reader at wavelength 450nm (Normal IgE antibody level, titre (0-100 IU/ $\mu$ l).

## Results

Although all of the study women were not previously diagnosed for any type of allergy, 27 (84%) of them have had mild to severe allergic symptoms (at the time of the study). Collected data revealed a relationship between the number of smoked cigarettes per day and the strength of allergic symptoms, Figures 1 and 2.



**Figure 1: Distribution of type of smoking among the studied women according to their ages.**



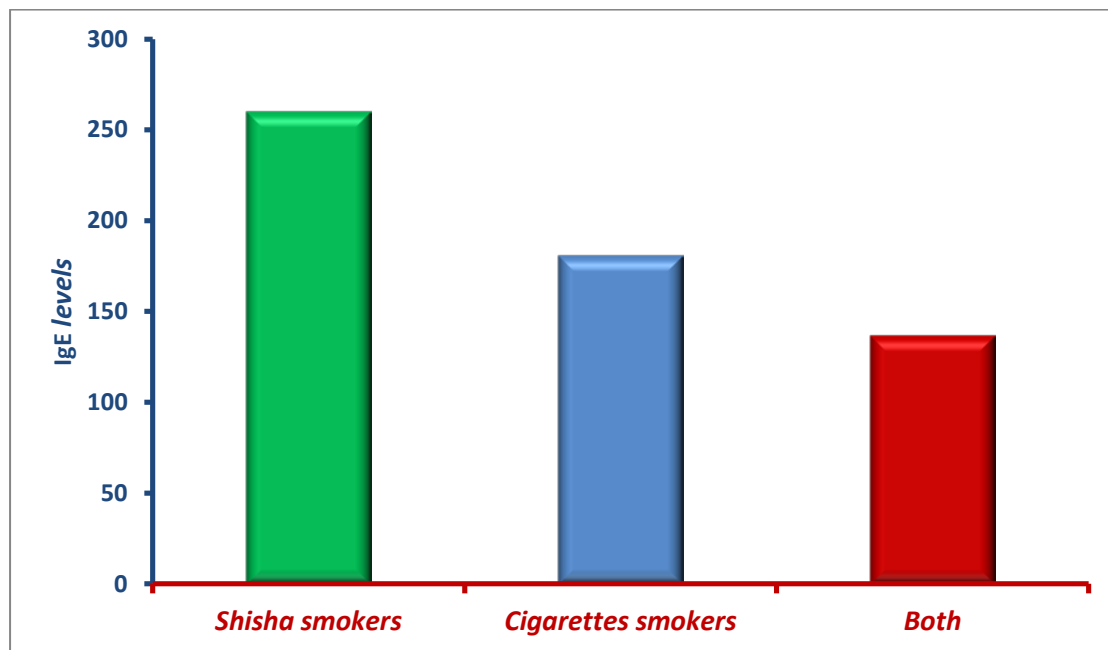
**Figure 2: Correlation between number of cigarettes smoked per day and classification of allergic symptoms.**

The complete blood count (CBC) of 24 women showed non-significant increase in (platelets and WBC's) among smokers, while hemoglobin levels showed an obvious elevation compared to controls, Table. 1.

**Table 1: Mean values of some selected blood parameters of the studied smoker women.**

	WBCs	Hb	Platelet
<b>Smokers</b>	$10^3 \pm 1.1$	$12.7 \pm 2.1$	$290 \times 10^3 \pm 75$
<b>Control</b>	$10^3 \pm 1.4$	$12 \pm 1.6$	$155 \times 10^3 \pm 125$

14 (43%) smoker women (most of them aged 23-26 years) have had an increased IgE levels (titre > 100 IU/mL). Mean levels of total IgE were increased among all women under study who uses various smoking types. The highest IgE levels were detected among those who only use shisha, followed by shisha and cigarettes smokers while cigarettes smokers showed the lowest mean levels among studied women, Figure. 3.



**Figure. 3: Comparative outlook of total IgE mean levels among women using different smoking types.**

## Discussion

Earlier surveys are likely to have underestimated the prevalence of smoking among women in Khartoum, given social norms that would be expected to inhibit truthfulness about their current and past behavior. In this study most of volunteered smoker women who use both water pipe and cigarettes were found between the ages of 23-26 years. This reflects that the social acceptance of cigarettes and shisha smoke is more common among younger women and is getting worse by the day (Sopori, 2002). The present study demonstrated increased IgE levels among women who smoke only shisha compared to those who smoke both shisha and cigarettes. This might be explained by the fact that women who smoke both cigarettes and shisha are mainly cigarettes smokers and they irregularly use shisha. While shisha smokers as Eissenberg *et al.*, (2008) stated, are displayed to the toxic effect of shisha due to high levels of tar and nicotine which is estimated to be equal or more than 100 cigarettes and induces greater immunologic changes. It has also been observed by Richter *et al.*, (2008) that the highest IgE levels were mostly detected in sera collected from women who use special cigarettes brands. This agrees with Fowles and Dybing, (2013) who discovered a variation across cigarettes brands in which specific brands of tobacco has reduced effect compared to other different types. In addition, an obvious relationship between the duration of smoking and the onset of the allergic symptoms was revealed in the study, as well as the number of cigarettes smoked per day and the severity of allergic symptoms (Nagasak and Matsumoto, 2013). Apart from that, blood samples from smoker women who were screened for complete blood indices showed non-significant increase in blood standards, these results are contrary to other findings, in which Velazquez *et al.*, (2013) noticed an obvious increase in CBC

count among cigarettes and water pipe smokers pointing to the effect of tobacco which causes an activation of resident cells and the recruitment of inflammatory cells. Furthermore, genetic diversity may influence variation in the complete blood count as previously reported by Evans *et al.*, (1999) who pointed that common environmental factors such as dietary iron intake and exercise are important in influencing and regulating complete blood count. This study concluded that smoking (either cigarettes or water pipe) among Sudanese women is a real social problem with an enormous health consequences and this may increase the risk of developing further allergic diseases.

### Acknowledgments

We gratefully acknowledge the technical assistance of Mr. Abubakr M. Elfakki, Al-farabi Medical Center, Khartoum, Sudan.

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