

## STUDY ON THE EFFECT OF CIGARETTE SMOKE ON HUMAN HEALTH

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(Received 3 May 2019, Revised 3 July 2019, Accepted 12 July 2019)

**ABSTRACT :** Smoking is considered as one of the major lifestyle factors influencing the health of human body. Current study was aimed to investigate the effect of smoking on immunity comparing to nonsmoker via assessment levels of total white blood cells (WBC), C. reactive protein (CRP), interleukin-6 (IL-6), zinc and copper levels. **Samples & methods:** Fifty smokers and forty nonsmoker persons were included the study, blood samples (5 ml) were taken from both (smoker & nonsmoker) persons to investigate WBC, Hb and PCV % by auto analyzer hematology, IL-6 by ELISA technique and C. R. P. by i- Chroma device as well as levels of zinc and copper were estimated by absorption spectrophotometer. The results were indicated to increased significantly ( $P < 0.05$ ) the mean value of WBC, Hb, PCV, IL-6, CRP and copper in serum of smoker persons as compare with nonsmoker persons while the mean value of zinc was decreased significantly ( $P < 0.05$ ). cigarette smoking effect on immune system and blood contents of smoker persons.

**Key words :** Copper, zinc, CRP, cigarette, IL-6, smoking.

### INTRODUCTION

Tobacco is the chief cause of avoidable death internationally<sup>1</sup>. Consuming tobacco might lead to diseases influencing the lungs, heart, and liver. Smoking is a main risk factor for chronic obstructive pulmonary disease (chronic bronchitis and emphysema as well), heart attacks, mouth, larynx and pancreatic cancer. The effects depend on how much the person smokes and on the duration that a person smokes. Ingesting of nicotine with smoking is the quick and effectual methods of introducing it into the bloodstream. It is taking virtually ten seconds for the material to reach the brain<sup>2</sup>. Smoking is a chief risk factor for heart attacks, myocardial infarction, emphysema, and cancer<sup>3</sup>. Tobacco smoke exposure to neutrophils elevates the oxidative burst causing tissue destruction by a direct toxic effect<sup>4,5</sup>.

Immune system could be affected by cigarette smoking, and could be a risk factor for osteoporosis. Osteoporosis results from decreasing the lymphocytes that produced by bone marrow. This mechanism could be happen when ones exposed to cigarette smoke. Reduce the time of polymorph nucleus (PMN) in the post mitotic pool of the bone marrow, and increases the size of the mitotic and post mitotic pools of PMN result spend through stimulating the bone marrow in heavy smokers' peoples. Thus, leukocytosis has seen in smokers as a result of these changes<sup>6,7</sup>. Increasing in number of immune cells

and mast cells are some of systemic immune alterations, in addition to several pulmonary disorders, where arisen due to cigarette smoking<sup>8</sup>. Tobacco smoke contains numerous compounds; the important substance of material is being the carcinogen (such as poly cyclic aromatic hydrocarbons), nicotine, carbon monoxide, irritant substances and other gases<sup>9</sup>. Some metabolic and biological processes of our bodies have effected by smoking including effects the hormones secretion<sup>10</sup>. Depletion in minerals and important nutrients including zinc are risks factors of nicotine addiction<sup>11</sup>. Zinc also inhibits the aromatase enzyme that converts testosterone in to excess estrogen; the high estrogen activity results in increased risk of heart disease, and this support the fact the smoking is a risk factor of heart diseases<sup>12, 13</sup>. Cigarette's smoke may be related to etiology of cancer and various diseases due to generate a large number of free radicals<sup>14, 15</sup>. Tar, carbon dioxide, carbon monoxide, nicotine, hydroquinone, ammonia, acetone, cadmium and nitrogen oxides are major components of smoke that might lead to numerous of the venomous effects<sup>16, 17</sup>. Most of these agents are known to be toxic to the cells and carcinogenic<sup>18</sup>. Indeed, nicotine and tar have shown to be immunosuppressive by affecting the innate immune response of the host and growing the susceptibility to infections. High levels of nicotine induce greater immunologic changes than lower levels of this compound<sup>19</sup>. Serum C - reactive protein (CRP), the main

acute phase protein, is a sensitive marker for systematic inflammation in human. CRP produced mainly in liver as a result to inflammatory stimuli in response to pro inflammatory cytokine. Cigarette smoking is one of a major risk factor for developing a condition that can be assessed by serum CRP<sup>20</sup>, that activates complement, as it's an opsonin to enhance phagocytosis process. It was found that the elevated level of CRP may be considered as a marker for many inflammatory diseases like lung cancer<sup>21, 22</sup>.

Our physiological processes are in need to an important and essential trace metal which acts as a ligand to numerous enzymes and proteins. Copper is a vital and main part of dopamine  $\beta$ -hydroxylase. Dopamine  $\beta$ -hydroxylase is an enzyme that mediates most of neurological functions through converting neither dopamine to nor epinephrine. In addition, copper helps form and superoxide dismutase, an antioxidant and cytochrome oxidase, a component in oxidative phosphorylation. Copper also acts as a ligand to peroxidase II<sup>22</sup>. This study was designed to assess the effect of smoking on some immune parameters like total white blood cells (WBCs), C-reactive protein, interleukin-6, as well as levels of zinc and copper in serum of smoker persons.

## MATERIALS AND METHODS

This study was performed using (50) samples of blood collected from smoker persons in Karbala city, and forty samples were collected from nonsmoker individuals who were not suffering from any chronic inflammation as a control group. The samples were subjected to measure a total white blood cells (W.B.Cs), hemoglobin level (Hb), packed cell volume (PCV), IL-6, CRP, zinc and copper levels. The blood samples (0.5 ml) from EDTA tube were put in automated analyzer for hematology (W.B.Cs, Hb and PCV) analysis by Genex device system, in addition (3-4 ml) of blood putting in plain gel tube in order to obtain serum. By using absorption spectrophotometer, measurement trace elements (zinc & copper) as described by manufacturer company (Spectrum Com. Egypt). Also, IL-6 was measured by ELISA technique (Elabscience Com. China) and C. R. Protein levels were done by i-Chroma device. All data that obtained were analyzed biostatistically by SPSS ver. 18 at P value 0.05.

## RESULTS AND DISCUSSION

The results of present study showed significant differences in levels of W.B.Cs count, P.C.V % and Hb concentration between two groups (smoker and nonsmoker persons) as in table 1.

Also, the results indicated that the levels of CRP

and levels of IL-6 were increased significantly in smoker persons as compared with nonsmoker persons as shown in table (2).

On the other hand, zinc and copper are the main trace elements involved in the immune responses also affected by cigarette smoking where zinc levels were decreased significantly in smoker persons as compared with nonsmoker, while copper levels were increased significantly in smoker persons when compared with nonsmoker persons as illustrated in table (3).

The present study, which included 50 smokers at age group 25 to 65 years, and all male, in addition, the study included 40 non-smokers and did not have any chronic infections as control group. The study found that there are many changes in blood and immune parameters to the smoker as compared to non-smokers, and this study agreed with Jahan and Qaz's study<sup>16</sup>, who stated reducing the time of polymorph nucleus (PMN) in the post mitotic pool of the bone marrow, and increases the size of the mitotic and post mitotic pools of PMN result spend through stimulating the bone marrow in heavy smokers' peoples. Thus, leukocytosis has been seen in smokers as a result of these changes<sup>7</sup>. Many studies have shown a significant relationship between CRP and increased the risk of lung cancer<sup>23, 24</sup>. Furthermore, it is suggested that lung cancer may be associated to circulating proinflammatory cytokines; IL-6 and interleukin 8 (IL-8) are expressed in pre-malignant epithelial cells, and thus, are of particular

**Table 1 :** The results of W. B. Cs, P.C.V. and Hb parameters in blood of smoker and nonsmoker persons.

| Hematological parameters | Smoker persons | Nonsmoker persons | P value |
|--------------------------|----------------|-------------------|---------|
| W. B. Cs (cells)         | 11750          | 6780              | < 0.05  |
| P. C. V. ( %)            | 48.7           | 41.9              | < 0.05  |
| Hb (g/dl)                | 15.8           | 12.85             | < 0.05  |

**Table 2 :** Mean value of IL-6 and C. R. P. levels in smoker and nonsmoker persons

| Immunological parameters | Smoker persons | Nonsmoker persons | P value |
|--------------------------|----------------|-------------------|---------|
| IL- 6pg/ml               | 45.31          | 14.41             | 0.01    |
| C. R. protein mg/L       | 16.81          | 4.32              | 0.001   |

**Table 3 :** Mean value of zinc and copper levels in smoker and nonsmoker persons.

| Biochemical parameters  | Smoker persons | Nonsmoker persons | P value |
|-------------------------|----------------|-------------------|---------|
| Zinc level $\mu$ g/dL   | 54.51          | 91.7              | 0.01    |
| Copper level $\mu$ g/dL | 166.28         | 90.9              | 0.001   |

interest. This expression is associated with a poor prognosis in lung cancer patients<sup>25, 26</sup>. Zinc levels and serum iron are regulated by IL-6 via control of their transporters. Inducing hepcidin production by IL-6 regulates serum iron. At opposite, serum iron level decreased through blocking the action of iron transporter ferroportin 1 on gut and<sup>27</sup>. This means that anemia and hyperemia are resulted by IL-6-hepcidin axis in case of chronic inflammation. Also, it enhances zinc importer expression on liver cells and so induces hypozincemia seen in inflammation conditions<sup>28</sup>. Elevating level of lipid peroxidation and dwindling level of antioxidants as a result to imbalance in systemic oxidants-antioxidants in enduring/permanent cigarette smokers. Body temperature increases through a process called energy mobilization that stimulated by IL-6 in muscle and fatty tissue. In response to specific microbial molecules, IL-6 could be secreted through macrophages process<sup>29</sup>.

Zinc is the only metal appears in all enzyme groups; it is considered the most important trace element in human. Zinc and iron are the most plentiful transition metal in organisms. Smokers were having lower value of serum zinc compared to nonsmokers. However, the value of serum copper was higher in smoker as compared to nonsmokers. A similarity finding was obtained by Ho and Ames<sup>30</sup>. DNA and protein metabolism and synthesis are dependent on zinc. Decreasing in the level of zinc will result in disruption of the p53 tumor suppressor protein and oxidative DNA damage. Thus, put smokers in danger of developing larynx or lung cancer. One factor that could lead to mutation, which consider a phenomenon of many sites' cancer, is diminishing of zinc level in serum<sup>31</sup>.

### Compliance with ethical standards

This study was not funded by any funder.

Conflict of interest: no conflict of interest.

Ethical approval: All participants were agreed to be part of this study informally.

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