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Correlation between Smoking and COVID-19 Symptoms: A review study

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ABSTRACT— Smoking and OVID-19 may have a very bad effect on lungs because the local defenses are affected and due to the increases in the production of mucus that causes infection particularly in the respiratory system leading to illness. The current review is to provide evidences from previous studies regarding the correlation between tobacco and corona virus. The findings of the previous studies shows that there are a common symptoms that smokers have that share with COVID-19 patients, among them are; inflammation in immune systems, inflammation in lungs and respiratory system, however the risk of mortality in smokers if they are infected with COVID-19 is more than nonsmokers. Smoke and nicotine affect lungs, respiratory and immune systems, both smoke and corona virus share the same effects on the same organs and the same genes affected with smoke and COVID-19.

KEYWORDS: COVID-19, smoking, inflammation, respiratory system

1. INTRODUCTION

It is well known that smoking is risky for the health and has bad consequences on the health of human being; this is because smoking may had a very bad effect on lungs because the lungs local defenses can be affected and the production of mucus can be increased causing infection particularly in the respiratory system leading to illness [1], [2].

Corona virus (COVID-19) caused by virus (SARS-CoV-2) that spread easily, its symptoms usually varied from one to other, some people need hospitalization and need to be in intensive care unit and may need machine helps to breathe, while other people have no symptoms, however it is an infectious disease that affect the respiratory system (especially lungs) and the symptoms may develop to dangerous particularly in old age people who suffered from cardiovascular diseases, weak immune system, lung diseases, obesity, chronic disease (diabetes, hyper blood pressure), those people are under high risk [3- 5].

2. How immune system affected with smoking

Before discussing the correlation between smoking and the immune system, it is important to mention general facts as the following:

- Smoke comes from the combustion of tobacco contains a harmful compound among them are nitrogen oxides, carbon monoxide, nicotine, cadmium, and volatile compounds [6], [7].
- Exposure to the smoke of tobacco is considered as a significant cause of death that can be prevented [8], [9].
- Smoking cause development in diseases in cancers, heart diseases, respiratory diseases and infection [10], [11].
- Smoking has consequences on human tissues, and organs as well as it affects the microbes in gut [12].

- The toxic compounds in the cigarettes have effects on the microbiota that may promote production of certain cytokine in the cells causing increases in mucin (high molecular weight protein) [13].

3. Smoking and inflammation in immune system

The main function of the immune system is to protect the body from infections that causes by viruses, bacteria and fungi (germs), and also it is also lower the risks of the inflammation that caused by toxins that caused by microbes/and or chemicals, however the immune system consist of variety of proteins, cells, and organs all of them are work together to defense the human body from invaders (germs/and or toxics chemicals) that came from outside [14], [15].

As it is known, the smoke of the cigarette has many toxic compounds; figure 1 shows the classification of these compounds according to their effect on immunity.

Figure 1: toxic compounds in cigarette smoke [14]

In 2012, [14] found that the smoke of the cigarette is the main reason of mortality and morbidity because it induces oral diseases, vascular diseases, chronic lung, and as appear in figure 1, there are many toxins compounds that have immunomodulatory special effects, in addition to that the smoke of the cigarette also contains lipopolysaccharide and bacterial components which may induced inflammation at mucosal layer that may develop the exogenous antigens which may induced the effect on suppressive and pro-inflammatory, these and other CS constituents induce chronic inflammation at mucosal surfaces and modify host responses to exogenous antigens. The effects of CS on immunity are far-reaching, however the effect may be varied upon many factors such as; the tobacco, stimulation time of the immunity cells, inflammatory mediators, and the toll of the receptors ligands. The study also find that the smoke of the cigarette may also weaken the innate defenses towards pathogens, autoimmunity, and the presentation of modulate antigens. Figure 2 shows the genes that may affected by smoke of the cigarette as concluded by [16]

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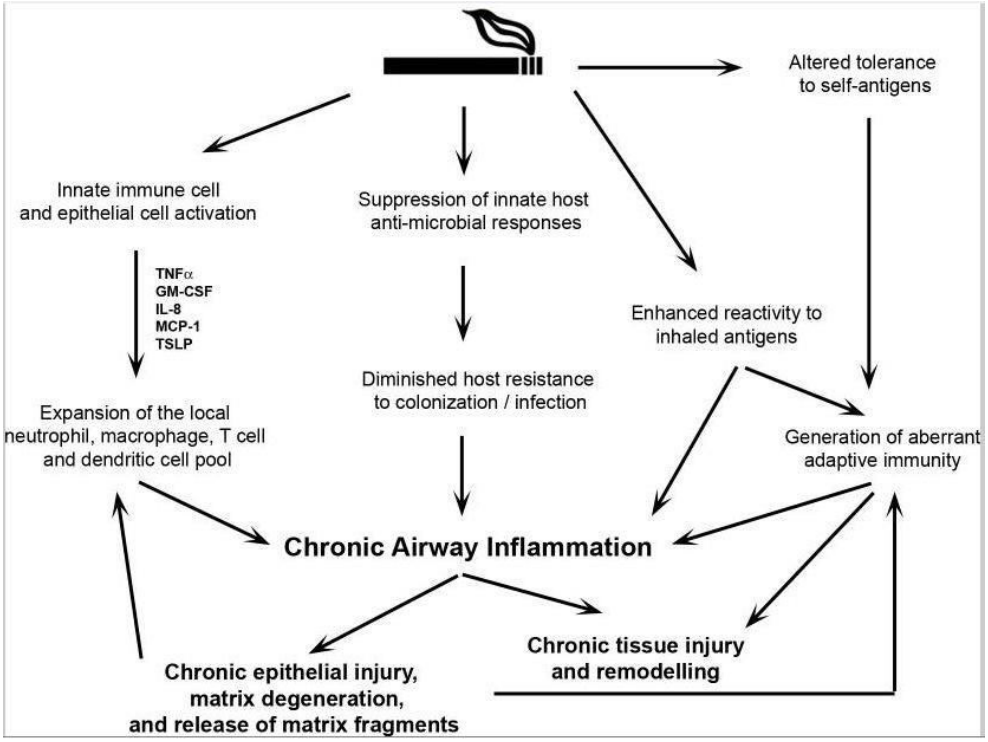

Figure 2: Modulates inflammation of the Cigarette smoke (CS) [16]

In 2021, [17] came up with conclusions that smoking cause raising in the body inflammation through inducing increases in the quantity of proinflammatory bacteria which may produce a certain fatty acids (short chain) that may inhibit the inflammation, while this phenomena is not exist in non-smokers [17]. In the same year 2021, [18] concluded that the metabolomic profile and the composition of gut microbiota are varied between smokers and non-smokers, the researchers reached that there are a heterogenic effects of CS that may leads to atherosclerotic pathogenesis [18].

[19] mentioned that smoking has serious affects on health causing diseases and has impact on immunity and innate and may modify the immunity by attenuation of defensive immunity or exacerbation of pathogenic immune responses which may effects T cells (Th17, Th2, Th1) as well as CD4, CD8 and CD25 in addition to many diseases such as transplant rejection, cancers, allergies, autoimmune diseases, respiratory, and cardiovascular.

[20] study how smoking affects the inflammatory innate, markers, the responses of adaptive immune toward viral and bacterial and also how smoking affects the composition of the blood cells and they found the CEA, IL-6, IL-8, fibrinogen, CRP, and a number of cytokines, chemokines are considerably and significantly higher in smokers than non smokers (control group) [19].

4. Characteristics of COVID-19

Coronavirus, is a virus that belongs to Coronaviridae that vitions enveloped (built of outer protein shell called a capsid and an inner core of nucleic acid (either DNA or RNA), the capsid provides specificity to the virus while the core confers infectivity.

The diameter of coronavirus is about 120nm and has a coronal or crownlike shape and appearance. The capsid is containing the viral nucleic acids, is either tubular or helical, it is consists of a single ribonucleic acid RNA. Coronaviruses are viruses that cause diseases in humans, however, its starts in birds and

mammals causing respiratory tract infections that can range from mild to lethal. Figure 3 shows the most well-known shape of COVID-19 [21].

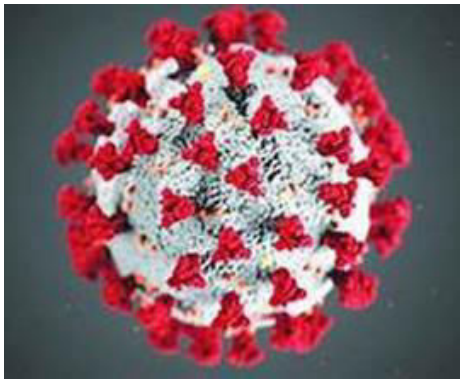

Figure 3: COVID-19 [22]

Clinically, the diagnosis of coronavirus usually is based on molecular diagnostics or clinical manifestations to the genome via CT-Scan, X-Ray, RT-PCR and blood test (serologically).

The most frequent irregularity and defects are [23], [24]:

- Elevation in inflammatory biomarkers,
- Elevation in CPR,
- Thrombocytopenia,
- Leukopenia,
- Lymphopenia
- Abnormality in liver functions,
- Defects in renal functions,
- Albumin decreases,
- Elevation in cardiac biomarkers

[25] found that the most common markers and symptoms in COVID-19 patients are; disorder in smell and test, weakness, diarrhea, while [26] concludes that the most important biomarkers are; cough, fever, dyspnea, and fatigue shortness in breath, chills, headache… and more. In 2022, [27] and his coworkers did longitudinal cohort studies on the patients and found that patients seen high heterogeneity in the meta-analysis. However, in 2021, [28], the researchers identified 11 genes affected with CPVID-19 infections and the key genes are AGT and IL6 which are involved in viral infection, cytokine activity and regulating the responses of the immune system.

5. Smoking, COVID-19 and respiratory infection

It is well known that smoking and COVID-19 have tract infections on the respiratory system and lower the function of lungs [29- 31], many studies confirm the correlation between smoking and increasing the viral infections risks which includes changes and modifications like activation of the hallmarks and epithelium in airway biology I addition to epithelial barrier dysfunction, fibrosis, mucus hypersecretion, mucociliary clearance in addition to immune response alteration [32- 38]. All these changes are the same in COVID-19 patients, as depicted by [39], [40], [41]

Figure 4 shows the smokers infected with COVID-19 are higher mortality than non smokers [42]

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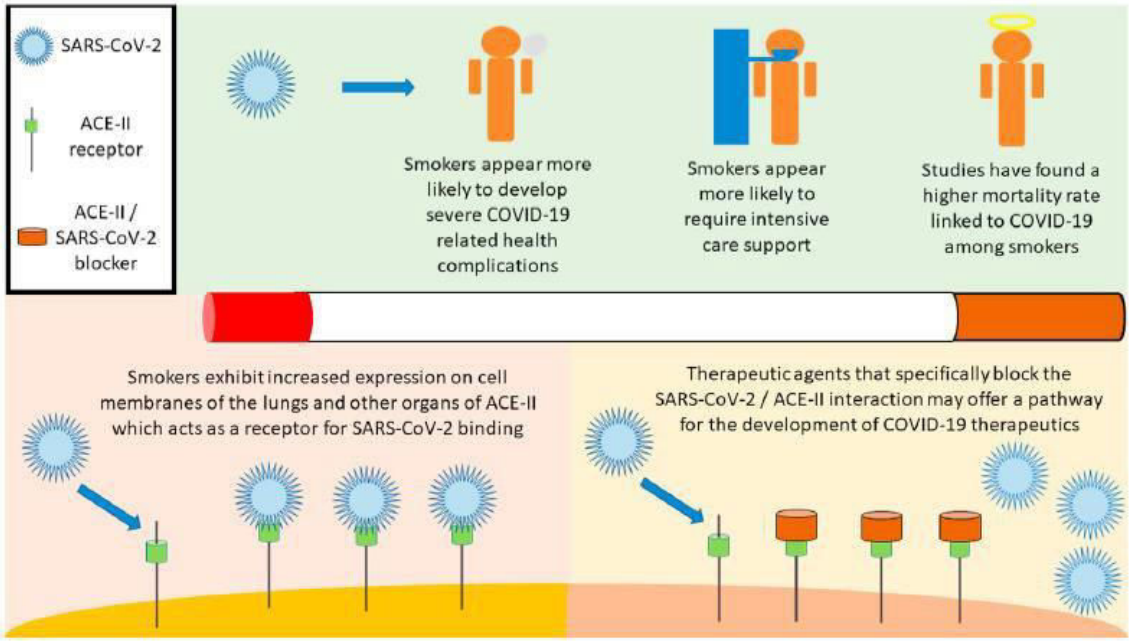

Figure 4: High percent of mortality in smokers than non smokers [42]

Shastri et al., 2021 [43] mentioned that smoker patients can develop severe COVID-19 symptoms than non-smokers, figure 5 shows the correlation between smoke, tobacco, nicotine and the infection with SAR and corona virus [43].

Investigations indicated that nicotine, which is the main psychoactive compound in cigarettes; stimulate Interlukin-6 (IL-6) expression, which was proven by experimental work on cells treated with nicotine [44].

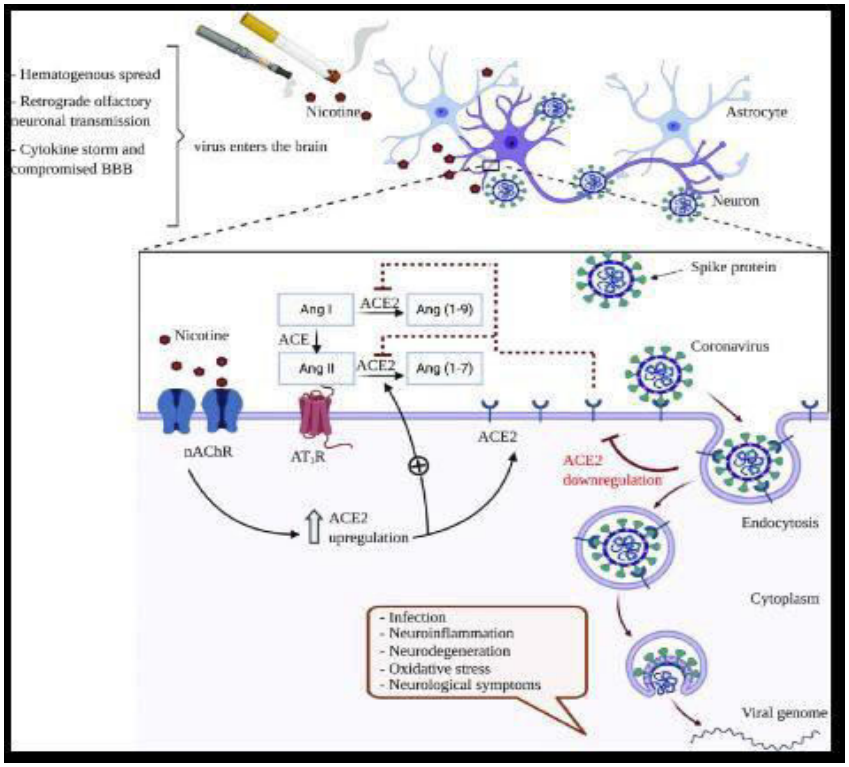

Figure 5: correlation between smoke and corona virus [43]

The majority of tobacco-related research studies considers smoking as a single, homogeneous exposure and classifies smokers as ever/never smoker, current/former smoker, or heavy/light smokers, another classification called latent class analysis classified smokers into eight classes which are: [45]

- ***(Class I)*** comprised entirely former regular smokers with lowFagerstrom Test for Nicotine Dependence (FTND) scores, who reported no anxiety or depression about smoking quit attempt.
- ***(Class II)*** also had low (FTND) scores; but they were all current regular smokers and only 27% had made at least one smoking quit attempt with little or with no depression or anxiety.
- ***(Class III)*** nearly half of them still smoking regularly and reported low FTND scores, and all of them tried a serious attempt to quit smoking with little depression or anxiety [44].
- ***(Class IV)*** comprised primarily women (74%) and former regular smokers (88%). Smokers of this class reported moderate FTND scores, had made at least one serious attempt smoking quit, it was reported an anxious mood subsequent to these quit attempts.
- ***(Class V)*** currently smokers on regular basis and exhibited high FTND scores, and few tried smoking cessation.
- ***(Class VI)*** are mostly males (78%), and roughly half of this class currently smoked on regular basis. Smokers of this class reported moderate FTND scores; all had managed stopping of smoking, and half of the class made more than two attempts with little or no depression or anxiety.
- ***(Class VII)*** are primarily current regular smokers with moderate FTND scores who made repeated attempts to quit smoking and reported high anxiety or depression with their quit attempts.
- ***(Class VIII)*** most of them began smoking regularly at a young age, reported high FTND scores, and made several serious trials for smoking cessation with high anxiety or depression with their quit attempts. Some of these attempts proved successful; 45% of the smokers of this class were former smokers.

It is also important to mention that Smoking is one of the main causes of oxidative stress, producing various free radicals in the body and ultimately causing damage to vital macromolecules. The total antioxidant capacity (TAC) and plasma malondialdehyde (MDA) have been considered important surrogate biomarkers of oxidative stress evaluation [46].

6. Conclusions

- Smoke and nicotine affect lungs, respiratory and immune systems.
- COVID-19 cause inflammation in respiratory and immune system.
- Bothe smoke and corona virus share the same effects on the same organs.
- Smokers at high risk of mortality if they are infected with COVID-19.
- Same genes affected with smoke and COVID-19.
- cigarettes; stimulate Interlukin-6 (IL-6) expression.
- Eight classes of smokers were classified according to their anxiety and depression.
- Smoking causes of oxidative stress, producing various free radicals in the body.

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