

Indoor Air Quality, Health Effects Resulting from Coffee Shops Smoke – Review

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ABSTRACT

All over the world, people are drawn to stay most of their time in indoor environments and largely in restaurants and cafes. For this reason, the aim of this study is to provide information to decision-makers and researchers about indoor air pollution in cafes and its significant impact on people's health. Cigarettes, hookahs, and electronic cigarettes abound in cafes frequented by young people (Most of them are school students) and some women, In addition, to minors. The main sources of pollutants in coffee shops are heating, cooling, cooking, and emissions from shisha, cigarettes, and e-cigarettes. The most common pollutants are CO, PMs, NO_x, SO_x, and VOCs, in addition to nicotine. Health effects appear in adults, children, and women, they affect otitis media, and heart disease for children, while it is on heart attack, nasal irritation, lung cancer, and coronary heart disease. As for its effects on the pregnant woman and the fetus, it affects reproduction and low birth weight. This review could be for environmental legislators for Iraqis, in international organizations to formulate legislation for indoor air for cafes that takes into account all sources of air pollution to create a healthy and comfortable environment. The review is also useful for cafe managers and customers to understand the potential health risks of indoor air pollution.

Keywords: coffee shop, pollutants, human health, guidelines, Indoor air quality.

INTRODUCTION

Around the world, people want to spend approximately 90% of their time in different indoor environments [Mehzabeen et al., 2021], and about 60% of employees and workers work indoor environments as offices [Tsakas et al., 2010]. Figure (1) shows the percentages of people's spent time in different indoor places [Mehzabeen et al., 2021]. Cafes are the most indoor places people spend their time drinking coffee or tea, smoking hookah, drinking juices, and soft drinks, or eating sweets, and this negatively affects the indoor air quality. Some cafés are literary cafés in which writers sit for consultation and discussion [America's First Coffeehouse, 2010]. In addition to smoking, hookahs, shisha, and electronic cigarettes, there are factors such as air exchange rate, external climate, and weather conditions affects the indoor air quality [Célia et al., 2010]. Indoor

Air Quality (IAQ) studies provide assessments of air quality inside all types of buildings (residential, public, and commercial). IAQ is the description of contaminants concentrations and thermal conditions which may adversely affect human health, comfort, and effectiveness of a building's residents [Sam, 2017]. Bad indoor air quality IAQ can be especially harmful to vulnerable groups such as kids, teenagers, and the elderly, [Alessandra, 2017]. Indoor air can cause adverse effects on human health, which may appear soon or later from chronic exposure [EPA, 2013].

The phenomenon of hookah smoking among Iraqi youth, which is widespread today in cafes and public roads, poses an effective threat to life and has become an individual behavior among young men and women, as the matter has evolved to include young people, adding a new burden on Iraqi society. Where the molasses, the charcoal of the hookah, and its deadly smoke, the

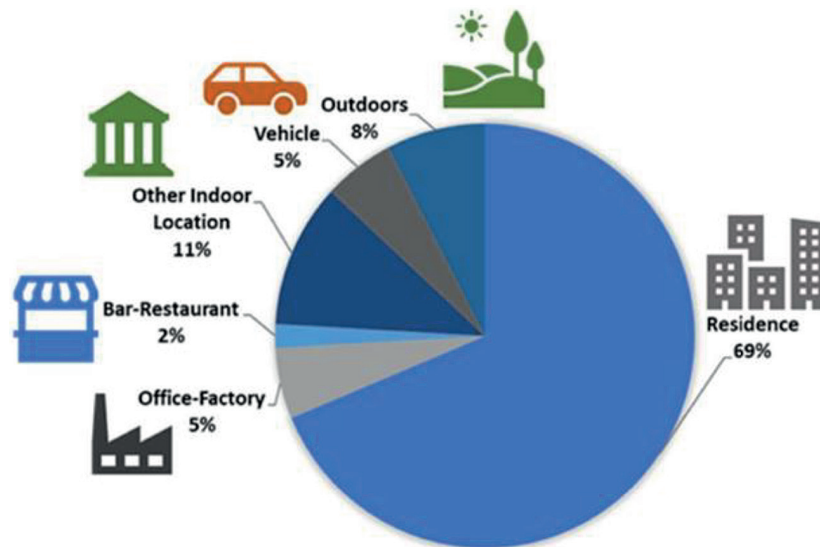


Figure 1. Percentage of time people spend indoors and outdoors [Mehzabeen et al., 2021]

people become the smell of its smoke. This scene is increasing daily among adolescent children between the age of ten and fourteen years. Perhaps the reasons are many, including the physiological changes of the adolescent, especially the young people who have their own decision, which drives them to try everything that is new, trying to rebel against themselves, and the weakness of control. Parents and changing the value system in addition to the social vacuum factor resulting from unemployment [Nazar, 2016].

Smoking hookah or shisha is recent in Iraq, as the phenomenon spread after 2003, especially in the capital Baghdad, and northern Iraq, was limited to male youth only, it began to aggravate in the years 2009, 2010, and 2011 to include girls and children of different ages [Al-Delaimy, 2021]. In Iraq 2019, The Global Youth Tobacco Survey (GYTS) was conducted by the Ministry of Health and WHO. The overall response rate was 89.0%. from 2,560 eligible students in the first-third middle completed the survey, of which 1,686 were aged 13–15 years [GYTS, 2019]. The

results are shown in Figure 2. In cafés, what is worrying is that many café-goers are exposed to forced smoking and illnesses from non-smokers inhaling the prevailing smoke [U.S. Department of Health and Human Services, 2006]. Through several distinct ways, exposure occurs from the prevailing smoke, which is the smoke inhaled by the smoker and then exhaled, or the smoke of the sidestream, which is the smoke emitted from the burning of tobacco, or the smoke that has permeated the air of the surrounding environment (IARC, 2006), or exposure by people present in coffee shops who are not smokers may occur from secondhand smoke (THS), from tobacco smoke in dust, or collected on surfaces [Sleiman, 2010]. The SHS and THS are produced from cigarette smoke, but there is no confirmation yet that they are produced from other tobacco products. Water-pipe, nargile, or hubble-bubble is safer and less addictive than cigarettes, and evidence has shown that cigarette smoke is less harmful than hookah [Daher, 2010; St Helen, 2014]. The aim of this study is to provide a comprehensive review that

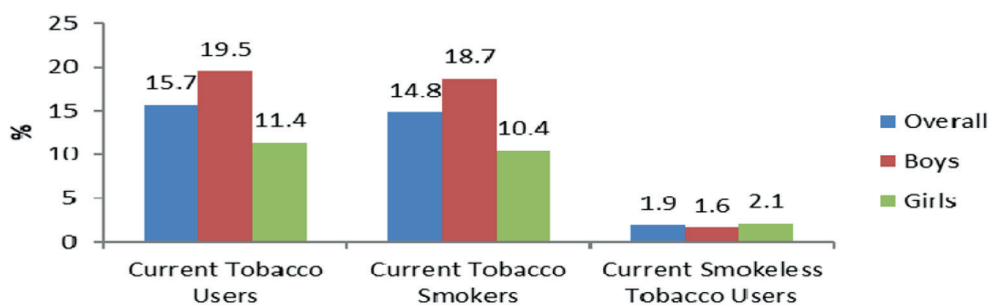


Figure 2. Current tobacco use among students aged 13–15 years – Iraq, GYTS, 2019

reveals potential indoor air pollution in cafes, its effects on health as a result of exposure to smoke, and to develop the necessary measures to reduce pollution, to be available to specialists and cafe customers, and to indicate the measures to be taken to reduce damage to health, especially for adolescents and youth.

MATERIALS

In this study, several questions were raised about the pollutants resulting from air pollution and their impact on human health, and their answers were based on the literature and reports, and the literature available in the EMBASE database, PubMed, and on the reports issued by the World Health Organization (WHO) and issued by the Ministry of Health, so that we can Access to outcomes that achieve the objective of this study.

RESULTS AND DISCUSSION

The air pollutants resulting from coffee shops

Coffee production is widespread in developing countries in about 50 countries between Latin America, Asia, and Africa. Benefiting 20–25 million families around the world. Where the coffee production is consumed from cultivation, collection, and processing to the hands of many workers. Then the industrialized countries start roasting, such as France, Brazil, Germany, and the United States [Petit, 2007]. Roasting is done either by companies or in cafes, and coffee of different origins is mixed together. The coffee beans are heated between 370–570 degrees for 8–15 minutes, depending on the degree of roasting required, as when the temperature increases, the darker the coffee becomes, When coffee is roasted, the moisture present is lost, and then a chemical reaction occurs that turns the starch into sugar, breaks down the proteins and changes the cellular structure of the grains [Tuvhag, 2008]. During the roasting and packaging process, gas is emitted [Salamone, 2003].

Smoking shisha has spread lately in Baghdad, believing that shisha is less dangerous than cigarettes, because shisha smoke is drawn through the water before the smoker reaches it [Al-Easawi, 2014]. Although hookah smoke is similar to cigarette smoke. Hookah smoke contains many

dangerous substances such as heavy metals (cobalt, lead, arsenic, and chromium) [Maziak, 2004]. Heavy metals are deposited on tobacco leaves from the air, or fungicides or insecticides, which contain toxic metals that are sprayed on tobacco leaves or from the soil during the growth process The plant absorbs minerals from the soil, especially if it is sludge, fertilizers or contaminated irrigation water. Surgeon (2010) and Nada (2015) studied indoor air pollution in two cafes in the city of Baghdad, from the results on hookah smoke, it was found that there are large amounts of heavy metals in both cafes, they are the mean concentration value of (Pb, Zn, Co, Ni, Cr) at site 1 (11.004, 9.544, 24.088, 19.84, 24.98 $\mu\text{g}/\text{m}^3$), respectively, while the mean concentration values of these heavy metals at site 2 (5.574, 6.578, 16,684, 26.114, 9.636 $\mu\text{g}/\text{m}^3$), respectively, exceed the standard limits of the World Health Organization.

Tobacco smokes, Cigarettes, and cigar smoke contain the same compounds, but some of these compounds are different in concentrations. According to U.S Food and Drug Administration (FDA), nicotine, cadmium, lead, acrolein, acetaldehyde, benzene, ammonia, carbon monoxide, 1,3 butadiene, and tobacco-specific nitrosamines are some of the chemicals in cigars [US Food & Drugs, 2021]. Cigarettes and cigars smoke consist of particles and gases, which are produced from the burning of their components. The quantity of each component differs according to the kind of burned product and the conditions of smoke generation. The major compounds of tobacco smoke are nicotine, nitrosamines, carbon dioxide, carbon monoxide, nitrogen oxides, acrolein, formaldehyde, and hydrogen cyanide [Sibu et al., 2007]. Air pollution by these smokes could be of considerable worry especially in places of poor ventilation because of their adverse impact on the levels of indoor particles and gases [Ebisiike et al., 2004].

The water pipe is utilized to smoke sweetened and flavored tobacco with many of the same compounds as in cigarettes and cigars. Many studies have demonstrated that waterpipe smoking consists of various components of different harmful contaminants such as particular matters (PM), CO, NOx, Volatile organic compounds VOCs, Polycyclic Aromatic Hydrocarbons PAHs, volatile aldehydes, nicotine, phenol, and more [Kadhun et al., 2015; Daher et al., 2010]. As it was reported by various researchers, these contaminants are present at higher levels in water

pipe shops, as a comparison with the outdoor air. So, High quantities of these contaminants indoors reduce the quality of the indoor air, and this will expose people to health risks [Akl et al., 2010].

Recently, electronic cigarettes (e-cigarettes) are vastly utilized as a style of non-tobacco nicotine smoking. This tool consists of a heating unit (atomizer), power supply, and a reservoir, which holds a solution (e-liquid) that usually contains different amounts of nicotine, vegetable glycerin, flavorings, and other chemicals. Various studies have demonstrated that electronic cigarette aerosol consists of PM, formaldehyde and other VOCs, aldehyde, and heavy metals [Rui et al, 2018]. As these e-cigarettes have not been in common use for long, there is limited data on their long-term effects. However, epidemiological studies demonstrated that PM_{2.5}, which exists at high levels in e-cigarette coffee shops, causes pulmonary diseases and cardiac diseases [Hugo et al., 2020]. Like tobacco cigarettes, utilizing e-cigarettes causes an increase in fine and ultrafine particle concentrations in the indoor air environment [Liqiao et al., 2020].

The most affected ages groups by the air pollution in coffee shops

Roughly 1.1 billion smokers reside worldwide, 80% of smokers living in low- and middle-income countries, and about 26 countries are currently either in a state of conflict or in post-conflict conditions [Global Conflict, 2016]. About 1.5 billion people worldwide live in hazardous to extremely dangerous conditions [Global Conflict, 2016]. Evidence suggests an

association between smoking and conflict [Lo et al., 2016; Keinan, 2011; Roberts, 2013], as well as post-traumatic stress disorder (PTSD) [Fu, 2007; Cook, 2009]. The reason could be that tobacco smoking relieves stress [Lo et al., 2016]. In Iraq, smoking prevalence rates are estimated at 31% and 4% for males and females respectively [WHO, 2013]. The global survey of tobacco among young people (13 to 15 years) conducted in Kurdistan, northern Iraq, showed that the prevalence of smoking, in general, is 15.3%, 25.1% among men and 2.7% among women, and the prevalence of smoking in the Arab countries appeared in the Figure 3, the Figure 4 shows the number of adult male smokers in Iraq and the Arab world, while Figure 5 shows the number of adult female smokers in Iraq and the Arab world. In contrast, in a similar Greek study where tobacco use is considered very high, the prevalence is estimated at 10.4% [Warren, 2008]. Figure 6 shows the number of people who die annually as a result of diseases related to tobacco smoking in the Arab world, as 23,007, 14,499, 9,447, and 819.4 are the number of people who die as a result of smoking-related diseases in Iraq, Yemen, Syria, and Lebanon. Health problems related to tobacco smoking are responsible for 10.73% of deaths in Iraq. Currently, there are about 4.4 million smokers in Iraq. [Middle East Market, 2016], as in Figure (6).

One study found that the use of e-cigarettes by adolescents under the age of 18 may make them potential smokers in the future, and found that the consumption of tobacco products with e-cigarettes, before the age of 18, is a risk factor, The researchers also found that

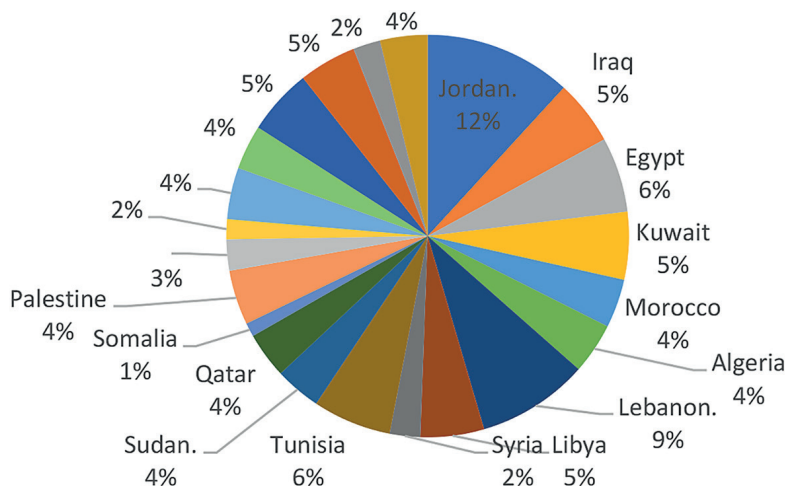


Figure 3. Smoking prevalence rate in Arab Countries

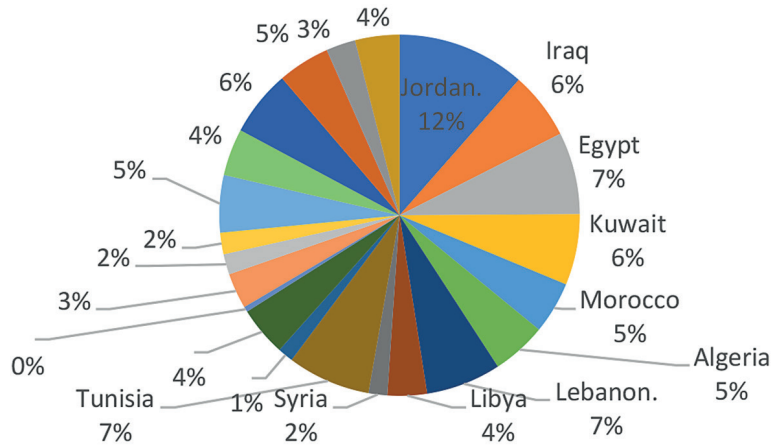


Figure 4. Adult male smoking prevalence rate in Arab Countries

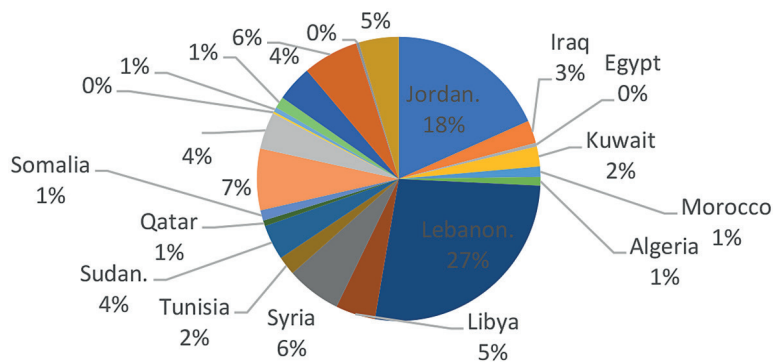


Figure 5. Adult female smoking prevalence rate in Arab Countries

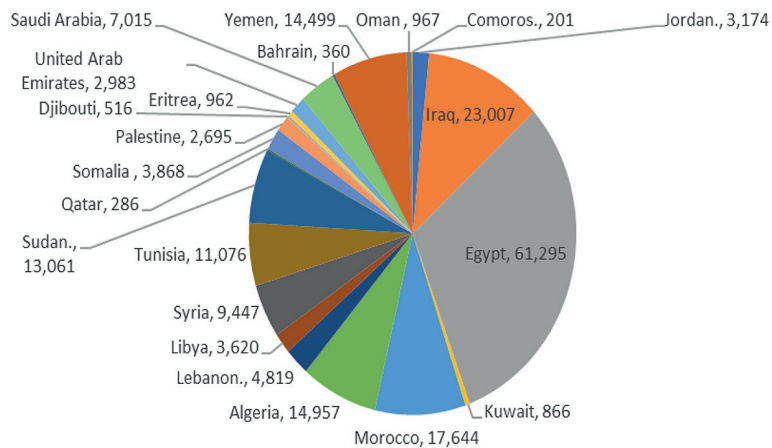


Figure 6. People die every year due to tobacco smoking in Arabia Countries

adolescents aged 12 to 24 who use e-cigarettes are three times more likely to become cigarette smokers. And 12% for those aged between 18 and 21 years. E-cigarettes depend on nicotine, which makes their consumption exposes their users to addiction to traditional cigarettes [Yedira, 2021]. The National Institute on Drug Abuse (NIDA) has determined that the

conversion rate of e-cigarette users to smokers to hookah is 45%. and other tobacco products 50%, which negatively affect their health in the future, it was found in the United States America that 38% of high school students use electronic cigarettes in 2016, rising to 45% in 2019, this is a rapid growth of electronic cigarette users [Yadira, 2021].

The geographical location of effect on tobacco use in cafes

Tobacco use varies by geographic location, including cigarettes, and smokeless tobacco. People who live in certain areas and communities often experience poor health due to tobacco use, especially cigarette smoking. For example, by the U.S. census, the number of Cigarette smokers among adults is highest among those living in the Midwest (22.2%) and the South (22.7%), and the lowest among those living in the Northeast (20.1%) and West (16.3%) because people in the Midwest and the South use Multiple tobacco products, such as cigarettes and smokeless tobacco. They also found that smoking among adults living in rural areas (28.5%) while in urban areas (25.1%), and also found that those who live in small urban areas (22.0%) and large urban areas (18.3%). the rural health effects are more harmful to health than in urban areas due to economic, social, cultural, and health care factors [Verlinden, 2015].

Factors affecting the spread of air pollutants in cafes

Many factors related to indoor air quality affect the environment, health, and well-being:

Relative humidity

Relative humidity is the ratio of the quantity of water that air can hold at a specific temperature. Relative humidity of less than 25% may be led to discomfort and dry skin and mucous membranes, which can cause irritation. On the other hand, high humidity can cause a condensation case inside the building, and this is a suitable environment for the growth of dust mites, bacteria, and mold [Alves, 2020]. Hence, this will result in respiratory and allergic diseases. ASHRAE set a guideline for the indoor relative humidity to be $\leq 65\%$ [ASHRAE, 2017].

Temperature

The influence of temperature on humans is significant and more than he recognizes, especially as it relates to productivity. The meaning of thermal comfort is connected to human metabolic heat generation, the transmission of heat to the ambiance, and physiological modifications. The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

recommended that the operative temperature range from 23 to 28°C in Summer and from 20 to 25.5°C in Winter [Kristýna et al., 2015]. Proper temperature is the basic requirement for indoor air. Extreme indoor temperatures are a serious health hazard (Healy 2003, Kosatsky 2005) and extremely high or low temperatures are considered unpleasant. Too high a temperature for example exacerbates the effects of a lack of moisture [Reinikainen and Jaakkola, 2001]. There are also another factors such as Pets and pests, Humidity, and Chemicals. Ventilation, Particles, Microbes, Radon, Particles, Microbes

The impact of secondhand smoke on human health

Secondhand smoking comes from the smoke at the end of cigarettes, or from what smokers exhale, as secondhand smoke contains more than 7000 chemicals. Hundreds of substances are toxic and about 70 substances can cause cancer.1,2,3,4. secondhand smoke does not have a risk-free level for Infants and children, through asthma attacks, respiratory infections, ear infections, and sudden infant death syndrome (SIDS) (U.S. 2014a). More than 1,000 babies die each year due to smoking during pregnancy. secondhand smoking in adults causes coronary heart and vascular diseases (U.S. 2014b), and stroke, in addition to lung cancer. Figure 7 shows a schematic diagram showing the environmental effects of secondhand smoking, secondhand smoking also affects children as it causes respiratory symptoms, lower respiratory diseases (U.S., 2014b), lung diseases, and sudden infant death. In adults: smoking Causes nasal irritation and genital effects in women. It also causes Lung cancer, stroke, low birth weight, coronary heart disease, cardiovascular disease is causing coronary heart disease, and stroke. the U.S. recorded 34,000 deaths from secondhand smoke. about 25–30% of non-smokers develop heart disease, while 8,000 die from stroke annually. It also affects the blood and blood vessels and increases heart attack. Secondhand smoke causes lung cancer, a rate of 20–30%.(U.S. 2006), and more than 7,300 lung cancer deaths among non-smokers in the United States each year. Sudden Infant Death Syndrome (SIDS) is the sudden, unexplained and unexpected death of an infant in the first year of life. SIDS is the leading cause of death in healthy infants. [American Academy of Pediatrics, 2005] secondhand smoking increases the risk of SIDS, due to

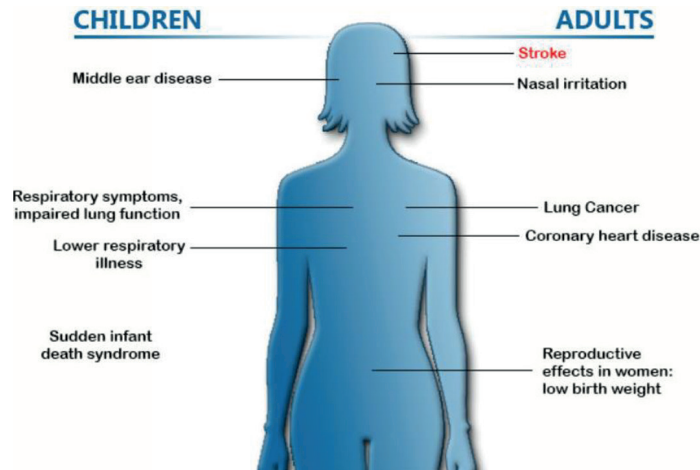


Figure 7. Health consequences causally linked to exposure to secondhand smoke [Suresh, 2021]

women smoking during pregnancy [CDC, 2019]. It can also affect children by increasing coughing, wheezing, and asthma attacks more than once. It can cause ear infections [Suresh, 2021].

Negative impact of tobacco and hookah on health

Hookah smoking and its health effects

Three harmful health effects resulting from smoking hookah: It leads to damage to the heart and blood vessels, and it also leads to cancer. Table 1 shows the diseases associated with smoking hookah and the deaths that result from it, which are attributed to cardiovascular diseases. Some studies that study the effects of hookah did not exclude people who regular smoking, so the results may be based on the biological effect of smoking cigarettes and hookah [Al Numair, 2007]. A previous study conducted, noted systolic blood pressure, diastolic blood pressure, heart rate, and

carbon dioxide levels were significantly elevated after hookah smoking (Murtaza, 2014). The same results were observed in studies from Jordan and the United Arab Emirates [Shaikh, 2008]. The parameters described above were significantly higher in smokers of hookah, compared to cigarette smokers. Finally, in chronic hookah smokers, systolic blood pressure and heart rate remained significantly elevated for all age groups [Shaikh, 2008]. In the serum of hookah smokers, high concentrations of NO were observed (34.3 µl/l) while it was (22.5 µl/l) for non-smokers. This causes vasodilation, remodeling, and dysfunction. A single shisha smoking session greatly affects platelet function. The incidence of 8-epi-prostaglandin F2 alpha and malondialdehyde, two signs of oxidative stress in the human body, increases with a rise. 20 11-Dehydrothromboxane B2, and it rises after one smoking session. A study reported that continuous daily smoking leads to long-term oxidative stress. This increases the risk of coronary heart disease and arteriosclerosis [Wolfram,

Table 1. Summary of the health effects of hookah smoking [Kadhun, 2014]

The risk from hookah smoke	These effects
Cardiovascular damage	<ul style="list-style-type: none"> • Due to irregular and low heart rate, the risk of arrhythmias increases • A number of reasons lead to increased risk of coronary heart disease due to platelet imbalance and irregularity, decrease in HDL level, increase in LDL level, BP contraction, and BP diastole, with heart rate. The concentration of high-density lipoprotein (HDL) - it was observed that there was a decrease in cholesterol and lipoprotein (apo) A-1 in the blood serum of hookah smokers, and that low-density lipoprotein (LDL) - cholesterol, Apo B was also low, triglycerides and malondialdehyde were also found. It is higher for hookah smokers compared to non-smokers. This shows that hookah smokers are a risk factor for coronary heart disease. (Al Numair, 2007)
Infection	<ul style="list-style-type: none"> • Herpes infection, hepatitis infection and increased risk, tuberculosis by sharing horns
Cancer	<ul style="list-style-type: none"> • Risk of quadruple lung cancer, • bladder cancer, prostate cancer, oropharyngeal, esophageal and oral cancer, Oral dysplasia, squamous cell carcinoma

2003]. After smoking hookah, herpes, hepatitis, and tuberculosis (TB) may develop. When smoking as a group and not individually, through the horns, pathogenic organisms are transmitted between smokers through saliva. Infectious diseases spread through the wet nature of hookah molasses and this increases the growth of living organisms, cleaning the hookah despite the good management of cafes, but it is difficult to clean internally efficiently [Quit Shisha, 2015].

Chemicals enter the body through the hookah, which causes lung cancer, more than non-smokers, in addition to cancer of the bladder, pharynx, esophagus, cornea, and oral dysplasia, although there is no statistical significance [Akl EA, 2010].

Electronic cigarette (EC) smoking and its health effects

An electronic cigarette is sometimes called an electronic nicotine delivery system (ENDS). They are known to be safe and market ECs on this basis and give the feel of traditional smoking, provide pure nicotine and release harmless water vapor that disappears in seconds [Anon, 2014, Smoke, 2014]. During blowing, the spray and liquid activate the battery-powered heating element. The liquid consists of propylene glycol, nicotine, glycerin, flavorings, tobacco extracts, and/or aerosol/vapor containing nutrients [Etter and Bullen, 2011, Wall et al., 1988]. Nearly all smokers use ECs with nicotine [Etter and Bullen, 2011]. The new product has raised great concern among health professionals about the epidemic spread [Sglanz, 2014], who call for “harm reduction” and it is an alternative to traditional cigarettes and is more prevalent in the market and causes one billion deaths in this century [Eriksen et al., 2012].

Cigarette smoking and its health effects

Cigarette smoking during pregnancy is associated with a number of harms: placenta previa [Hung et al., 2007], spontaneous abortion [George et al., 2006], stillbirth [Hogberg, 2007], placental abruption [Ananth et al., 1999], Low birth weight [Jaddoe et al., 2008], preterm birth [Fantuzzi et al., 2007], fetal growth restriction [Hammoud et al., 2005], and sudden infant death syndrome [Mitchell and Millerade, 2006]. Smoking is the cause of death in about 90% (or 9 out of 10) of lung cancer patients. And in about 80% (or 8 in 10) patients with chronic obstructive pulmonary disease (COPD). Smoking is one of the

causes of heart disease, stroke, and lung cancer. Estimates show that smoking increases The risk: of 2-to 4 times the risk of coronary heart disease and stroke. Men are exposed to lung cancer more than women at rates are 25, and 25.7 respectively. Smoking causes cardiovascular disease at a higher rate than hookah [Zaher, 2004].

A stroke occurs when a clot occurs that blocks blood flow to the brain, causing a vessel to burst inside the brain, or obstructions caused by smoking reduce blood flow to the lower extremities and skin. With regard to the respiratory system, smoking damages the lung by damaging the respiratory tract, and the pulmonary alveoli. and chronic obstructive pulmonary disease caused by emphysema and bronchial tubes. Smoking causes cancer everywhere in the body: lung, mouth, lip, pharynx, esophagus, larynx, kidneys, pancreas, colon, rectum, cervix, or anywhere in the body [Rodriguez, 2020]. These diseases were shown in Figure 8.

Some recommendations for reducing the smoking in Coffeeshop

To control smoking there are many ways to mention them. Banning tobacco advertising and promotion, and obligating pictorial health warnings to be placed on tobacco products. Reducing tar and nicotine levels for cigarettes sold locally. Banning the use of tobacco products by persons under 18 years of age. And ban the sale of tobacco to young people and minors. The government should intervene to set procedures and laws to mitigate the dangers of shisha and its large and destructive spread, such as the National Tobacco Control Program. Parents should monitor their children, especially in adolescence, and advise them to confront some negative phenomena and practices (the phenomenon of the spread of hookah) “dangerous and destructive”. Determining the number of cafes that offer shisha for girls only, as some of them are (a mixture of sedatives). Substances that carry euphoria and greater pleasure, make the smoker addicted. Banning the licensing of cafes that provide hookah to youth under the age of 18, not selling hookah and its accessories to teenagers and young people under the age of 18, banning the provision of hookah in public places, and intensifying health control over cafes. Imposing penalties on violators. The shisha phenomenon that swept Iraq is a pathological condition created by unemployment, compelling

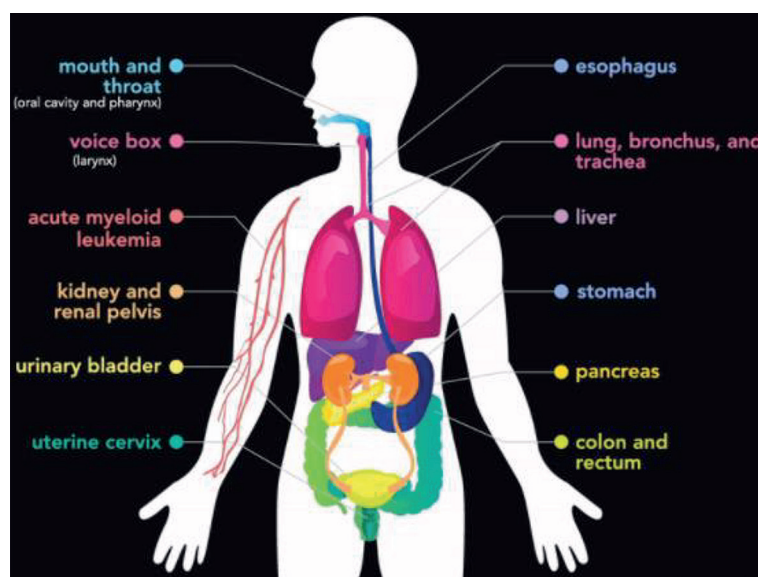


Figure 8. The health effects of cigarette smoking [Mica, 2022]

material pressures, and avoid that is not exploited with effective and useful activities, and therefore requires the exploitation of young energies to serve the country. The hookah in popular cafes has become a “fashion” and most of those who go to the cafe to drink are young people.

CONCLUSIONS

Through this study, it was found that the most prevalent pollutants in cafes are CO, PMs, NO_x, and VOCs, in addition to nicotine. It was found that smokers are mostly school students, youth, and women and that some cafes receive both sexes. The health effects are numerous, the most important of which is for an adult, the most important which is a heart attack, Nasal irritation, lung cancer, and coronary heart disease. As for its effects on the pregnant woman and the fetus, it affects reproduction and low birth weight. It also has an impact on children, as it causes otitis media and lung infections. Several steps have been developed that include the role of the state and the family to reduce the impact of smoking.

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