Cigarettes and Its Effects on Health

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ABSTRACT

Background: One of the biggest challenges in the world of health is the problem of smoking. In 2018, there was an increase in smokers at the age of 10-18 years by 9.1\% compared to 2013, which was 7.2\%. It is feared that the increasing number of smokers at a young age will increase the number of non-communicable diseases (NCD) at a young age. Methods: Writing this article uses the method of literature searching from various sources of information including e-books, websites and search engines. The e-books used contain cigarette information and its effects on health, the websites used are the website of the government and WHO to search for prevalence data and other information, and the search engines used are Google Scholar and Pubmed to search information on cigarette content research and its effects on health. Discussion: The content of cigarettes can cause various side effects in almost all organs of the body. Various studies have found that smoking is a risk factor for NCD. Conclusion: Cessation of smoking can save sufferers and also save people around smokers. When a smoker starts quitting smoking, the body will undergo the process of cleaning up toxic substances of cigarettes that have entered the body.

Keywords: cigarette, literature searching, NCD

INTRODUCTION

The problem of smoking is a challenge in the world of health that cannot be denied. Data from the World Health Organization (WHO) estimates that there are 1.1 billion smokers worldwide, 80\% of whom live in countries with lower middle income.\textsuperscript{1} In 2018, in Indonesia, there will be an increase in the number of smokers from the age of 10-18 years, from 7.2\% in 2013 to 9.1\%.\textsuperscript{2}

It is feared that the increasing number of smokers at a young age will lead to more human resources who are at risk of developing non-communicable diseases (NCDs). Smoking is closely related to the occurrence of various lung diseases. More than 80\% of the incidence of Chronic
Obstructive Pulmonary Disease (COPD) in the United States is caused by smoking.\textsuperscript{3} Also, smoking habits cause other NCDs such as hypertension, stroke, heart disease to cancer.

NCDs incident is closely related to the chemical content contained in cigarettes. Various studies have shown that smoking can be a risk factor for NCDs. It is estimated that smoking increases the risk of coronary heart disease about 2-4 times, stroke 2-4 times, lung cancer 25 times in men, and 25.7 times in women. Besides, smoking can lead to an increased risk of type 2 diabetes mellitus by 30%-40%.\textsuperscript{4}

Side effects from smoking are not only about the smoker (active smoker); people around smokers also get the impact. To prevent this smoking habit, cooperation from various parties, including government, medical staff, the communities, and religious leaders, are needed. This article was written to describe the health effects caused by smoking.

METHODS

The method for writing this article is through literature searching. Information is sought from various sources, namely from e-books, websites, and search engines. The book used is a book that has a discussion chapter on cigarettes. The site used is the Ministry of Health and WHO (for finding prevalence data and other information). Search engines used are Pubmed and Google Scholar.

DISCUSSION

Epidemiology of Smoking

Globally, there has been a decline in the number of smokers over the age of 15 from 23.5% in 2007 to 20.7% in 2015.\textsuperscript{5} There are several factors related to the decrease in the prevalence of smokers, namely increases in tobacco taxes and prices, anti-tobacco campaigns, access to services to stop using tobacco, and government regulations regulating tobacco products.\textsuperscript{6} The prevalence of smokers in Indonesia has increased from 7.2% in 2013 to 9.1% in 2018 in smokers aged 10-18 years.\textsuperscript{2}

Every year, more than 7 million deaths are caused by cigarette use, and 1.2 million are non-smokers exposed to cigarette smoke.\textsuperscript{1} A smoker's life expectancy is ten years shorter than someone who has never smoked.\textsuperscript{7} In reducing the number of smokers in Indonesia, the government seeks to make various health counseling, anti-smoking campaigns, regulate cigarette advertisements, and increase cigarette excise tax by 23% and retail price by 35%.\textsuperscript{8} This effort can help reduce the number of smokers in Indonesia.

Chemical Substances in Cigarettes

Since 1950, there has been an identification of the chemical components in tobacco.\textsuperscript{9} Until now, almost 7,000 chemical compounds have been identified in cigarette smoke. Of the 7,000 chemical compounds, 69 of them are known to be carcinogenic.\textsuperscript{10} Carcinogenic compounds are present in cigarette smoke such as acetaldehyde, arsenic, benzene, cadmium, ethylene oxide, formaldehyde, polonium nickel (Figure 1).\textsuperscript{11} Smoking is enjoying burned nicotine.

Nicotine is a specific organic compound contained in tobacco leaves. If we smoke nicotine, it will cause psychological stimulation of addiction. In addition to nicotine, the additives, flavoring, and aroma of cigarettes are also formed to fulfill the tastes of consumers (smokers). Currently, several types of cigarettes have been equipped with filters to reduce tar and nicotine levels.\textsuperscript{12} Even though you have used a filter, this does not mean that cigarettes will be safe for consumption, as some chemicals can still pass through the filter. Table 1 and Table 2 describe some cigarette compounds that can penetrate and be caught by the filter.
**Figure 1.** Illustration of the chemical substance in cigarettes

**Table 1.** The main chemical component of smoke caught in Cambridge filters

| Compound                  | µg/cigarette |
|---------------------------|--------------|
| Nicotine                  | 100-3000     |
| Solanesol                 | 600-1000     |
| Total nonvolatile HC*     | 300-400      |
| Catechol                  | 200-400      |
| Dihydroxybenzenes         | 200-400      |
| Neophytadienes            | 200-350      |
| Benzofuranes              | 200-300      |
| Linoleic acid             | 150-250      |
| Acetic acid               | 100-150      |
| Phenol                    | 80-160       |
| Nornikotine               | 5-150        |
| Oleic acid                | 40-110       |
| n-Hentriacontane          | 100          |
| Lactic acid               | 60-80        |
| Stearic acid              | 50-75        |
| Cyclones                  | 40-70        |
| Stearic acid              | 50-75        |
| Limonene                  | 30-60        |
| Bipytidils                | 10-30        |
| Scopoletin                | 15-30        |
| Skatole                   | 12-16        |

*HC: Hydrocarbon
Table 2. The main chemical component of smoke that passes through the Cambridge filter

| Compound             | Concentration/cigarette |
|----------------------|-------------------------|
| Nitrogen             | 120-280 mg              |
| Oxygen               | 50-70 mg                |
| Carbon dioxide       | 45-65 mg                |
| Carbon monoxide      | 14-23 mg                |
| Water                | 7-12 mg                 |
| Argon                | 5 mg                    |
| Methane              | 1,0-2,0 mg              |
| Hydrogen             | 0,5-1,0 mg              |
| Acetaldehyde         | 400-1400 µg             |
| Nitrogen Oxide       | 100-680 µg              |
| Acetone              | 100-650 µg              |
| Formic acid          | 200-600 µg              |
| Hydrogen cyanide     | 400-500 µg              |
| Propionic acid       | 100-300 µg              |
| Acetonitrile         | 100-150 µg              |
| Pyridine             | 20-200 µg               |
| Acrolein             | 60-140 µg               |
| Ammonia              | 10-130 µg               |
| Formaldehyde         | 20-100 µg               |
| Methanol             | 80-100 µg               |

General Disease Manifestations Due to Smoking

Smoking can increase the risk of various diseases. The ratio of smoking-related conditions compared to non-smokers (relative risk) is higher at a young age, especially in types of stroke and coronary artery disease. Common diseases often caused by smoking are described in Table 3. From 1965-2014, more than 20 million Americans died due to chronic conditions caused by smoking or as passive smokers, and complications due to smoking during pregnancy (Table 4).

The mechanism of chemical compounds in cigarettes in causing various side effects is a series of multiple stages. Toxic compounds and free radicals in cigarettes can trigger oxidative stress, inflammation to DNA damage that can trigger cancer. These chemical compounds can be taken by the body from the lungs and circulated in the bloodstream to reach almost the entire body.

- Smoking and cancer
  Smoking is the most significant risk factor for cancer triggers due to 30% of deaths in cancer patients. Various carcinogenic substances found in cigarettes. This carcinogenic substance can bind to DNA, causing mutations. If the body cannot repair this mutation, it will become cells that grow out of control and become cancerous.

  These substances in cigarettes also induce mutations in p53 protein. This p53 protein plays an essential role in regulating cell division and death. Mutations in this protein will cause uncontrolled cell growth that triggers cancer. The nicotine content can influence the occurrence of disease by activating angiogenesis, cell growth, and invasion of cancer cells.

- Smoking and lung
  Cigarette smoke can invite cytotoxic cells and inflammatory cells to trigger a pro-inflammatory effect on
Table 3. The relative risk of illness due to smoking\[^{[14]}\]

| Diseases                        | Smokers |         |         |
|---------------------------------|---------|---------|---------|
|                                 | Males   | Females |         |
| Coronary heart disease          |         |         |         |
| Age 35-64                       | 2.8     | 3.1     |         |
| Age ≥65                         | 1.5     | 1.6     |         |
| Cerebrovascular disease         |         |         |         |
| Age 35-64                       | 3.3     | 4       |         |
| Age ≥65                         | 1.6     | 1.5     |         |
| Aortic aneurysm                 | 6.2     | 7.1     |         |
| Cancer                          |         |         |         |
| Lung                            | 23.3    | 12.7    |         |
| Larynx                          | 14.6    | 13      |         |
| Lip, oral cavity, pharynx       | 10.9    | 5.1     |         |
| Esophagus                       | 6.8     | 7.8     |         |
| Bladder                         | 3.3     | 2.2     |         |
| Kidney                          | 2.7     | 1.3     |         |
| Pancreas                        | 2.3     | 2.3     |         |
| Stomach                         | 2       | 1.4     |         |
| Liver                           | 1.7     | 1.7     |         |
| Colorectal                      | 1.2     | 1.2     |         |
| Cervix                          |         | 1.6     |         |
| Acute myeloid leukemia          | 1.4     | 1.4     |         |
| Sudden infant death syndrome    |         | 2.3     |         |
| Infant respiratory distress syndrome |     | 1.3     |         |
| Low birth weight at delivery    |         | 1.8     |         |

Table 4. Total death caused by smoking and exposure to secondhand smoke (1965-2014)\[^{[6]}\]

| Cause of death                        | Total     |
|---------------------------------------|-----------|
| Cancer                                | 6,587,000 |
| Metabolic and cardiovascular diseases | 7,787,000 |
| Pulmonary diseases                    | 3,804,000 |
| Perinatal conditions                  | 108,000   |
| Lung cancer in secondhand smoke       | 263,000   |
| Coronary heart disease in secondhand smoke | 2,194,000 |

nasal epithelial cells, which will increase the production of Reactive Oxygen Species (ROS), Toll-like Receptor-4 (TLR-4), lipopolysaccharides and IL-17A synthesis. Moreover, cigarette smoke causes mucous hypersecretion so that the mucus cleaning process will be disrupted\[^{[17]}\]. Smoking decreases immunoglobulin levels in the circulation, decreases CD4\(^+\) lymphocytes, and decreases phagocyte activity. This process makes smokers become more easily infected. This immunological disorder will recover within six weeks when smokers stop smoking\[^{[3]}\].

- **Smoking and cardiovascular**

  Cigarettes have the property to cause inflammation. Smoking is associated with an increased risk of atherosclerotic plaque. This plaque formation is characterized by an inflammatory reaction and an increase
in the expression of matrix metalloproteinases. The pro-inflammatory effect occurs in not only an active smoker but also a passive smoker.\textsuperscript{[16]}

- Smoking and pregnancy

  The content of cigarettes can harm the fetus. Smoking habits during pregnancy are associated with the incidence of Low Birth Weight (LBW). This relates to the carbon monoxide (CO) due to the cigarette burning process, which can bind strongly to hemoglobin. A strong bond of CO with hemoglobin will reduce oxygen transport to the fetus, causing hypoxia in the fetus and LBW.\textsuperscript{[6,18]}

  Also, smoking during pregnancy is a risk factor for ectopic pregnancy. The content of cotinine (active nicotine metabolite) increases the expression of prokinetic (PROKR1) in the fallopian tubes. This process disrupts fallopian contractility and triggers ectopic pregnancy.\textsuperscript{[19]}

**Tips for Quitting Smoking**

Quitting smoking is not easy to do for smokers because nicotine addiction is one of the obstacles to quitting smoking. Quitting smoking is not impossible. Here are the ways you can stop smoking: \textsuperscript{[20]}

a. Strong inner determination. Consider first to make a list of reasons to stop smoking to sustain the determination

b. Think positive, and be sure to quit smoking successfully. Give a reward to yourself when the money is usually used for cigarettes and can now be used to buy favorite things

c. Set a target time. Never immediately stop smoking. Try to reduce smoking habits slowly

d. Give support to stop smoking, especially from the smoker’s family and friends

e. Look for activities to keep yourself busy. Activities such as worship, exercise, work can reduce the desire to smoke

f. Visit smoke-free places such as houses of worship, libraries or other places

g. Look for a substitute for smoking like gum, with the consumption of gum is expected to forget the smoking habit

h. Busy after eating. Most smokers after eating will start smoking again, so when you finish eating, try to busy yourself to forget about smoking

i. Consult a doctor. The doctor will prescribe drugs that can replace the effects of opium from nicotine to reduce tobacco frequently. Currently, the medications used to help stop smoking are nicotine, bupropion, and varenicline.\textsuperscript{[3]}

When smoking is stopped, the body will start a toxic disposal response and improve bodily functions. The effects of smoking cessation can be seen in Table 5.
Table 5. Benefits of quitting smoking[21]

| Start to stop smoking | Benefits |
|-----------------------|----------|
| 20 minute             | Blood pressure, heart rate and peripheral blood flow improve |
| 12 hours              | Almost all nicotine in the body has been metabolized The level of carbon monoxide in the blood returns to normal |
| 24-48 hours           | Nicotine begins to be eliminated from the body. The taste and smell function starts to improve |
| 5 days                | Most of the nicotine metabolites in the body are gone. Taste/taste and odor function is much better |
| 2-6 weeks             | The risk of infection in a post-surgical wound is reduced Ciliary airway function and pulmonary function improve Shortness of breath and coughing are reduced |
| 1 year                | The risk of coronary heart disease is reduced by half compared with people who continue to smoke |
| 5 years               | The risk of stroke decreases at the same level as people who have never smoked |
| 10 years              | All causes of mortality and the risk of coronary heart disease decrease at the same level as people who have never smoked |

CONCLUSION

Until now, smoking is one of the toughest challenges in the world of health. Smoking is a risk factor from various diseases to cancer. This is due to the different chemicals contained in cigarettes that endanger health. Stopping smoking is not only saving yourself but also protecting people around smokers.

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