Abstract: Giving up smoking is the best decision and there should be no other alternative. This is what science people say. According to them, one single cigarette contains not less than 70 cancer agents. Even the exposure to passive smoking may cause secondary effects that trigger long term diseases and even death. The risk is higher even with occasional smoking. According to some international reports, any cigarette contains a mixture of over 7,000 substances, out of which hundreds are toxic and less than 70 of them are cancer causing. Each exposure to the cigarette smoke and, therefore, to these chemicals, affects the DNA. As for the regular exposure, each new cigarette shatters the efforts of the body to repair what has been destroyed. Cancer causing substances reach with each and every inhaled „puff” the smokers’ lungs and the lungs of those around them, with effects soon to be recorded. It is not without reason that we consider smoking, guilty of 85% of the pulmonary cancer cases. And there is clear evidence that smoking is also responsible for other types of cancer, too.

Cancer causing agent in the tobacco smoke is the benzopiren. (2) (figure no. 1) which irreversibly links the DNA (3) (figure no. 2) either destroying the cell or creating a genetic mutation.

Figure no. 1. Chemical structure of benzopyrene

If the mutation inhibits the programmed death of the cell, the cell can survive, becoming a cancer cell. The benzopyren is 50.000 times more powerful in terms of cancer causing, than saccharine, which has been given a greater attention in this senses. (4)

Keywords: cancer agents, benzopyrene, Michael receptors, radioactive compounds

Cuvinte cheie: agenţi cancerigeni, benzopiren, receptori Michael, compuşi radioactivi

Rezumat: Renunţarea la fumat este cea mai bună decizie şi nu ar trebui să aibă alternative, spun oamenii de știinţă. Potrivit acestora, o singură ţigărană conţine mai puţin de 70 de agenţi cancerigeni. Chiar şi expunerea la fumul de ţigărană poate avea efecte secundare imediate la nivelul organismului, putând cauza boli pe termen lung şi chiar moartea. Riscul este mare şi atunci când se fumează doar ocazional. Conform unor rapoarte internaţionale ţigără conţine un amestec de peste 7.000 de substanţe, din care sute sunt toxice şi cel puţin 70 sunt cancerigne. Fiecare expunere la fumul de ţigără şi, prin urmare la aceste chimicale, afectează ADN-ul. În ceea ce priveşte expunerea regulată, fiecare nouă ţigărană dădărmice ţigărafixe de organismului de a încerca să repare ceea ce s-a distrus. Substanţele cancerigene ajung cu fiecare „fum” înhalat în plămânii fumătorilor şi a celor care fumează pasiv, efectele fiind imediate. Nu degeaba fumatul este vinovat de 85% dintre cazurile de cancer pulmonar, existând dovezi că este responsabil şi de alte câteva tipuri de cancer.
The DNA contains information on the cell functioning. In practice, it contains ingredients for proteins synthesis. If the mutation inhibits the programmed death of the cell, the latter can survive and becomes a cancer cell, a cell functioning just like a normal one. Carcinogenesis is radiomimetic, for instance it is similar to the one produced by the ionization caused by the nuclear radiation. Tobacco producers have experimented the consumption of the cigarettes without benzopyren, using the technology based on non-combustion vapours. These products have not become popular.

_a) Acrolein_ is a pyrolysis product, predominant in the cigarette smoke, conferring it a pungent smoke and an irritating, tear causing effect. It contributes dramatically to the cancer causing effect. As with the PAH, acroleine is an alkaline electrophilic agent, which permanently links with guanine, in the structure of DNA, causing the creation of a cyclic structure of hemiamine type. The acrolein-guanine link provokes mutations during the ADN-copying, and this fact determines cancers in a way similar to those produced by the PAH. Anyway, the acrolein is 1000 times more abundant in the cigarette smoke, comparative to the PAH and is capable of acting individually, without any metabolic activation. It has been demonstrated that acrolein is a mutating and cancer causing agent in the human cells. Carcinogenesis of acroleine has been difficult to study by experiments on animals, due to its toxicity which kills the animals before the cancer occurrence.(5) In general, the compounds capable to react through conjugated electrophile links (the so-called Michael receptors - after the reaction of Michael) are toxic and cancer causing because they may permanently alchilate the DNA, similarly with the toxic gases or the alphatoxin. Michael’s receptors contribute to the chronic inflammatory processes within the diseases caused by tobacco.(6)

_b) Nitrosamines_ represent a group of cancer causing compounds found in the tobacco smoke, but not in the tobacco raw leaves.

The nitrosamines are formed on the tobacco leaves during their processing through a chemicical reaction between the nicotine and other compounds contained by the leaf and with other hydrogen oxides in all the combustion gases. By the free burning of the cigarette, a reduction in the nitrosamines levels to less than 0.1 parts/million (7) has been proven. Some of the nitrosamines are shown as volatile gases (diethylnitrosamine = 0,01-0,171 µg). Most of them are yet nonvolatile (N-nitrosomonomine (0,14-3,70 µg/cigarette N-nitrosotabatine, N-nitrosodiaminolamine, nitrosopiperidine etc).

_c) Using_ the determinarion by chemiluminiscence, D. Hoffmann has found important differences in the contents of nitrosamine in the cigarettes, according to their nitrate contents, to the smoke blow they collected from through aspiration (primary or secondary blow), the stand-by cigarette etc. (8) (table no. 1).

d) _Aza-arenes_ or _heterocyclic hydrocarbons_ are represented by dibenz (a,h) acridine, dibenz (a,j) acridine and dibenz (c,g) carbazole, known as cancer causing substances. To these other substances with a mutation role, the following are added: quinolina, benzo (f) quinidine, benzo (h) quinoline and fenantridine. Their concentrations are of nanogramme order, 10-20 times higher than in the smoke released by the stand-by cigarette.

e) _There are 33 known nitriles_ in the cigarette smoke, most of them aromatic.(9)

_f) Aromatic amines_, such as beta-naftilamine, 4-aminozifelenile and ortotoluidine, are present in very small concentrations (1-3 ng/cigarette), and they can highly increase in the smoke of the cigarette kept in stand-by (for example: ortotoluidine reaches concentrations of 100-200 ng/cigarette in the inhaled smoke and 2000-3000 ng/cigarette in the smoke of a stand-by cigarette).

<table>
<thead>
<tr>
<th>Type of cigarette</th>
<th>Nitroso-</th>
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<tbody>
<tr>
<td></td>
<td>dimetilamine</td>
<td>etilmetilamine</td>
<td>dietilamine</td>
<td>pirolidine</td>
<td>normicotine</td>
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<tr>
<td>Common (1,1 g)</td>
<td>13 6800</td>
<td>1,8 9,4</td>
<td>1,5 53</td>
<td>11 300</td>
<td>250</td>
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<td>Through inhaling,</td>
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<tr>
<td>Free burning, stand-by</td>
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<td>Cigar, small (1,1 g)</td>
<td>30 1770</td>
<td>3,1 75</td>
<td>- 29</td>
<td>- 610</td>
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<tr>
<td>Through inhaling,</td>
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<td>Free burning, stand-by</td>
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<td>Cigar, Columbia (6.8g) through inhaling,</td>
<td>370 2350</td>
<td>52 75</td>
<td>21 61</td>
<td>640 13100</td>
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<tr>
<td>free burning, stand-by</td>
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<tr>
<td>cigar, common (7,5g) Through inhaling</td>
<td>70</td>
<td>10</td>
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<td>10 890</td>
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g) Other nitrogen compounds. It is estimated that in the cigarette smoke, there are more than 600 nitrogen compounds, out of which some are cancer causing: nitrophenols, some aromatic and aliphatic nitrohydrocarbures acetonitrile, aliphatic and aromatic amines (metilamine, aniline, pyridiloline). Some of them may be precursors of nitrosamines such as urethane, or hydrazine belonging to the maleic hidrazide used in the treatment of tobacco for preventing the growing of lateral branches and the proper development of the leaves. The hydrazine is found in quantities of 20–40 µg /cigarette, and 1,1-dimetilhidrazine and urethane is found in quantities of tens of nanogrames order.

h) Radioactive agents. In addition to the chemical cancer causing nonradioactive agents, tobacco and cigarette smoke contains small quantities of Pb\(^{210}\) and Po\(^{210}\), both being cancer causing radioactive agents. The presence of Po\(^{210}\) in the cigarette smoke has been experimentally measured at the levels of 0.0263–0.036 pCi (0.97–1.33 mBq), and this is equivalent to about 0.1 pCi/mg smoke (4 nBq/mg); or around 0.81 pCi\(^{210}\)Pb/g of dry condensed smoke (30 Bq/kg). The research undertaken by the chemist Ed Martell has shown that the radioactive substances in the cigarette smoke are deposited in the hot spots where the bronchia separate from each other. Since the gudron in the cigarette smoke is resistant to dissolving, under the action of the fluid in the lungs, the radioactive compounds have enough time to pass through the mucosa before they are cleaned in a natural way. In the interior, these radioactive compounds persist in the passive smoking and, therefore, a large exposure takes place when they are inhaled during the normal inhaling and this is deeper and longer than when inhaled from cigarettes. The destructions caused by smoking, at the level of the protective epithelial tissue, enhance the retention of insoluble Po210, which is produced through tobacco burning. Martell estimated that a dose of carcinogenetic of 80–100 razi is freed in the lung tissues by most of the smokers who die of pulmonary cancer.(10) The idea that Po\(^{210}\) is responsible for many cancer cases among smokers is accepted by at least one researcher.(11,12)

In order to highlight the effects caused by Po210 from the cigarette, we can make a comparison with what happens with Xrays used in a usual thoracic radiography. A modern thoracic radiography uses a dose of 0.034 mSv/radiography, therefore, a smoker of 20 cigarettes per day receives during a whole year a radiation dose equivalent to 300 thoracic radiographies.(13)

REFERENCES