DRINKING WATER QUALITY AND HEALTH THREATS

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Abstract

The aim of this work is to show threats to health resulting from consumption of bad quality tap water. The influence of selected organic and inorganic compound on human health has been considered as one of the most essential factors. Also the negative results of bed quality water consumption on health have been showed. Further the authors discuss the positive influence of drinking (tap) water eg. application of water with fluorine in fight with caries.

Keywords: drinking water, chemical & cancerous compounds, health condition

Introduction

Water, which is consumed (drinking water), comes from water supply (tap water about 50 %), from groundwater (about 50 %) and from others sources such as: deep-water springs, bottle-water (1 %). The installation which is used for water purification cannot remove all contaminants. In the end, in the drinking water, which we obtained there are all the possible toxins ( i.e. heavy metals, nitrogen compounds, cancerous compounds), which are lethal or toxic for living organisms [1].

The progress in medicine has led to control of contagious diseases and epidemics. In the recent years it has become even more difficult to fulfil all quality requirements. Due to this difficulties, the water we are provided with has been described as “uncertain” or
“periodically uncertain”. The drinking water has bad smell (phenols) and different taste (saltiness) [2].

**Materials and Methods**

All kinds of methods descriptive, statistical and analytic are used in the papers. As on initial method descriptive method was used separation and description of definite occurrences the influence of water quality on the state of population health. Further comparative analysis was done (used) point at all changes and irregularities as well as at deviations from accepted norms.

The results of carried out research were presented in tabular system, graphic forms and graphs.

**Results and Discussion**

Bad state of the environment [3] causes bad state of drinking water what have an influence on health. Basic health – requirement is to supply population with drinking water of suitable qualities. Three degree scale: good, unsure and bad water is used for water quality estimation [2]. Table No 1 presents the sanitary evaluation of water usaged by the population. In the years 1990-1999 drinking water obtained from waterworks and from wells improved in all cities. In villages in year 1999 the water quantity of unsure and from waterworks and wells has increased.


Many people suffered and died from numerous infectious diseases. Among the most frequent diseases are diphteria, cholera, dysentery, contagion with viruses eg. Virus hepatitis. Due to well projected (planned) drinking water and sewage systems the number of above menentional illnesses decreased significantly, some of them have disappered almost completely (diphteria) and the other (shigellosois) became less dangerous, do not need hospitalisation (Tab. 2).

There are in drinking water many negative chemical substances for health such as:

- Heavy metals (eg. Pb, As, Cr, Hg, Cd) and N-compounds.
- Cancerous compounds.
- Cl- compounds.
Chemical stressors: inorganic and organic compounds, alcohols, aldehydes, phenols, polyphenols compounds, toxic mineral compounds.

Metals cause many dangerous illnesses. In the ancient civilisations there was a threat of lead from drinking water. The result of negative influences on health was a common among Roman brain damage [5]. Excessive concentration of nitrogen in drinking water cause strong headaches, limbspains, muscles tensions, irritation of air passages and mucous membranes of eyes. Too high concentration of N- compounds mostly cause by children (to the six months at life) and elderly people – methemoglobine cyanosis, what results in loss of ability to assimilate oxygen by blood hemoglobin [6].

In drinking water there are also Cl-compounds, which were build as a result of water purification by certain dosis of Cl-compounds. The more sewage polutions are in the water, the higher dosis of Cl-compounds have to be applied. So, in the drinking water there are even more toxic substances after water purification by chlorine. Also other contaminants (eg. mounds, fungi, algas, bacterium) cause a serious health hazard. Applied chlorine, even in great amounts, is bound very strongly with organic compounds. In such a way the tap water will be very contaminated by 3-halomethans (chloroform, bromdichloromethane), which are strong cancerogenic compounds [5].

Great hazard of health is also caused by other cancerous-compounds, which are in the drinking water. American Cancer Society as the most dangerous for human health regards: vinyl chloride, asbestos, benzene, arsenic, aflatoxine. Also flow of water by installation made of lead, copper, asbestos or poor quality PCW [7]. One of the most dangerous cancerogenus-compounds is vinyl chloride [8]. It has been found out, that there is a migration of vinyl chloride from stiff PCW pipes used in the water supply system. In the case, if the water is delivered by pipes, were the process of PCW-monomer removal was not carried out, there the day PCW-uptake fluctuates from 0,06 upto 2,8 µg (allowed day consumption – zero) [5]. In polish health regulations there are not any norms for vinyl chloride.

Another cancerous-compound is asbestos, which can get into drinking water from cement-asbestos pipes. Due to poor water pipes quality it becomes more important to introduce norms of fibre asbestos in water [5] about 10 mcm in drinking water (in theUSA 7 million fibres/l water). Additional source of asbestos in drinking water are natural deposits, which are common eg. in Lower Silesia.

Certain but no great hazard for for human health is caused by arsenic. The skin cancer is caused by drinking water, which contains arsenic about 10µg/l. (6 persons for 10 thousand consumers). Polish sanitary norms allows arsenic content in drinking water - 50 µg/l [5].
Absorbed chemical stressors, which are not harmful for human health can become toxic, when they are taken too often and in too high quantities. So it is important to reduce excess of these substances. One of the ways to get rid of these substances is to attach acetyl-group to the harmful molecules. The acetyl-group increases dissolubility and therefore the excretion of chemical stressors by kidneys is more easier.

After discussion about toxic substances in drinking water the importance of fluorine [9], in water is presented. In many countries, also in Poland, the drinking water is enriched in fluorine compounds (optimal fluorine content - 0.8-1.2 mg/l). Fluorine causes decrease of intensity and frequency of caries. As it has been proved in many clinical researches fluorine added to water is one of the best prophylaxis forms in fighting caries. It reduces occurrence of caries average about 50 % [10, 11, 12]. After application of such kind of prevention it has been discovered, that caries occurrence was reduced about:

- 40-50 % in milk-teeth,
- 50-65 % in teeth.

The enrichment of water in fluorine accelerates the process of fluorine re-building in enamel. (cariostatic effect [13] - fluoride-calcium apatite [14] becomes resistant to acids activity). Beside this, fluorine causes remineralisation and reduction of caries potential of bacterium in tooth plate [15]. It also has an influence on the size of cavity, which means that cavities are small and simple/easier to treat and also has an influence on teeth mortality.

The enrichment of water in fluorine has been also introduced in Poland. Cities, where the fluorine has been added to drinking water are: Wrocław, Białystok, Szczecin, Kołobrzeg, Strzelin, Ścinawa, Osoła, Bydgoszcz, Dobroszyce, Lublin, Gdynia, Oświęcim, Zgorzelec, Starachowice, Zatonie, Grudziądz, Czarnków, Koronowo, Wejherowo, Legnica, Bartoszyce, Świebodzin, Strzegom, Złotoryja, Gryfice, Koźle, Chojnice, Poznań, Elbląg, Tarnów, Barcin, Ostrów Wlkp. i Branice (cities are stated in the sequence of introduction of this method) [11].

This method was introduced at the earliest in Wroclaw (1967) – the water was enriched with fluoridesilicate soda, content 1,128 mg/l [16, 17, 18]). It reduced caries about 70 % by the population of Wrocław.

On the base of carried out epidemic examinations [19] it has been stated that after 5 and 8 years of using this method a significant reduction of caries by children has been observed:

- in 1972 by 3-year old - 60.6 %; by 4-year old - 46.4 %, by 7-year old - 11.0 %,
- in 1975 by 3-year old - 76.7 %, by 7-year old - 44.5 % [11].

Similar effects have been obtained by older children teeth, 1972 – by 7–year old reduction of caries about 50% and in 1975 about 57.1 % [11].
As it has been showed above, the best results (decrease of caries intensity) have been obtained by children, who have drunk enriched water with fluorine since they were born. Important is not only enrichment of water with fluorine but also constant supervision over this prophylaxis method. Without such supervision reduction of fluorine in water is possible [20].

There are also in Poland several cities [Malbork (3.2 mg/l), Lubliniec i Kalisz (1.6 mg/l), Tczew (1.2 mg/l), Błaszki, Henrykow (2.464 mg/l)] where higher natural contents of fluorine have been found in drinking water [11, 16]. In the recent years this method has been abandoned, although it is the cheapest method of prophylaxis.

As it has been showed above, contamination of environment and further contamination of drinking water cause numerous consequences for human health. It has to be taken into consideration, that the influence of pollutants might not be observed in a long time. So it is important to undertake prophylaxis activities and to avoid irreparable changes [21, 22].
Table 1 *Sanitary evaluation of water used by the population*

<table>
<thead>
<tr>
<th>Specyfication</th>
<th>Urban areas</th>
<th>Rural areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>total</td>
<td>water evaluation in %</td>
</tr>
<tr>
<td></td>
<td>good</td>
<td>unsure</td>
</tr>
<tr>
<td><strong>WATERWORKS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public 1990</td>
<td>894</td>
<td>89,1</td>
</tr>
<tr>
<td>1995</td>
<td>966</td>
<td>91,6</td>
</tr>
<tr>
<td>1998</td>
<td>981</td>
<td>94,6</td>
</tr>
<tr>
<td>1999</td>
<td>1013</td>
<td>94,6</td>
</tr>
<tr>
<td><strong>WELLS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public 1990</td>
<td>3905</td>
<td>28,9</td>
</tr>
<tr>
<td>1995</td>
<td>2844</td>
<td>33,1</td>
</tr>
<tr>
<td>1998</td>
<td>2273</td>
<td>37,0</td>
</tr>
<tr>
<td>1999</td>
<td>2236</td>
<td>33,4</td>
</tr>
</tbody>
</table>

according to Rocznik [23]
Table 2 **Sick rate of infectious diseases and poisonings**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphteria</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>0,01</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Virus hepatitis</td>
<td>30276</td>
<td>8106</td>
<td>6729</td>
<td>78,5</td>
<td>21,0</td>
<td>17,4</td>
</tr>
<tr>
<td>Of which type B</td>
<td>9034</td>
<td>4074</td>
<td>3508</td>
<td>23,4</td>
<td>10,5</td>
<td>9,1</td>
</tr>
<tr>
<td>Salmonella infections</td>
<td>30093</td>
<td>26739</td>
<td>23436</td>
<td>78,0</td>
<td>69,2</td>
<td>60,6</td>
</tr>
<tr>
<td>Shigelllosis (Dysentery)</td>
<td>815</td>
<td>555</td>
<td>292</td>
<td>2,1</td>
<td>1,4</td>
<td>0,76</td>
</tr>
<tr>
<td>Other bacterial foodborne intoxications</td>
<td>3868</td>
<td>3840</td>
<td>3722</td>
<td>10,0</td>
<td>9,9</td>
<td>9,6</td>
</tr>
</tbody>
</table>

according to Rocznik [23]
Reference

1. Aquarius, materiały wewnętrzne dot. ochrony zdrowia z 2001 r.
2. Kozłowski St., Gospodarka a środowisko przyrodnicze, PWN, Warszawa, 1991
3. The greatest influence on the health state of the Polish have: live style - 53% and environmental conditions – 21%
4. The sanitary revolution was started by medicine doctor John Snow from London.
7. Monomer of vinyl chlorine is a basic component of PCW
8. Transparent gas with sweet smell, since 1987 regarded as cancerous factor.
9. Fluorine was introduced into mass caries prophylaxis (Dean – 1928).
10. Nowacka A., Zapobieganie próchnicy i chorobom przyzębia, Gazeta Stomatologiczna nr 2, 1996
13. Fluorine prophylaxis accelerates the process of building of fluorine into enamel (caristatic effect)
14. Enrichment of water with fluorine causes an increase of mineral parts of enamel (calcium apatite)
19. The examination was carried out in the whole city.
20. In Białoṣtok in years 1970-1975 was a reduction of fluorine in water - 0,53 mg/l (instead of 0,8-1,2 mg/l), what caused smaller caries reduction, then in other cities.
22. Ustawa z dnia 6 czerwca 1997 r. Kodeks karny, Dz. U.nr 88, poz. 553