NATURA MONTENEGRINA, Podgorica, 9(3):859-866

THE MICROBIAL POLLUTION IN POOLS AND DISEASES CONECTED WITH THEM

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Key words:
pollution, microbiological indicators, helminthes, swimming pool water, microorganisms.

SYNOPSIS

The aim of this study has been to monitore the microbiological pollution in the pools. Six pools were selected and monitored twice a month over a period, from May 2008 to September 2008. The sites were located near the Tirana and Durres regions, and at the same time near the wells which were supplying the pools with water as well as some villages wells around. We have analyzed 260 water samples from the pools. From our samples, most of them contained the general microflora up to the reference value and most of them had the *Total coliform* up to the allowed norms. The fecal indicators are higher than the referenced value. It's important to evaluate the indicators of sewage such as *Escherichia coli* and *Streptococcus fecal*, which in our study are in high value.
Out of 826 cases diagnosed by appropriate methods, 72 cases were found with fungi and *Chlamydia*. In addition, *Staphilococcus* was found in 39% of the cases.

INTRODUCTION

Microorganisms are continuously introduced into swimming pool water by swimmers, rain, dust, dirt and organic materials such as leaves and grass. In addition, dirty decks, toilets, locker room facilities, bathers, and personal items, are potential disease transmitters. To combat these sources of contamination, the pool operator must be concerned with the cleanliness and sanitation of the entire facility (Cabelli et al., 1976; Chamberlin & Mitchell, 1978).

The amount of microbial content in the pool is influenced by the pool's water organic content, pH, temperature, ambient light, turbidity, salinity, and especially the concentration of available disinfectant. Waste products like urine, fecal material and body oils contain numerous organisms that may cause diseases or infections.

Inadequate residual of a halogen-based disinfectants in the pool, increased bather loads, use of the pool by infected persons, and an imbalance in the water chemistry, greatly increases the potential for human illnesses (Fleisher et al., 1998).

Proper control of disease organisms is mandated by state and local health laws that require swimming pools be maintained to prevent the spread of diseases and infections that affect the skin, eyes, ears, noses, throat, and digestive system. Because swimmers often swallow pool water inadvertently, it is essential that the bacteriological water quality closely resemble drinking water. Infectious diseases have been associated with swimming pools and spa/hot tubs or therapy pools. The water can carry pathogens (diseases are caused by microorganisms) to the swimmer's gastrointestinal tract, skin, eyes, ears, noses, throat, and other areas of the body where bacteria can easily grow. For example, bacteria, such as *Salmonellae, Shigellae, Campylobacter sp., Giardia sp*. etc. have been associated with gastrointestinal illness when swimmers swallowed contaminated water (Cabelli et al., 1976).

Aside from gastrointestinal illnesses, infections acquired from pools include *Chlamydial conjunctivitis* (eye infection), pharyngonjunctival fever, coxsackie viruses, planter warts, athlete's foot and swimming pool granuloma. Illnesses associated with hot tubs include folliculitis, dermatitis, conjunctivitis (eye infections), pneumonia (lung infections), urethritis due to bacteria of the *Pseudomonas genus*, especially *P. aeruginosa*, and *Pontiac fever* (a form of legionnaire's disease) (Cabelli et al., 1976; Davies et al., 1995).

The bacterias found in swimming pools are generally dangerous and should be controlled. Certain bacteria produces poisonous substances (toxins) that can cause diseases, such as lockjaw, or food poisoning in humans. Other bacteria produces enzymes that can foul surfaces which we contact daily or contaminate equipment and food products. Some of the diseases of humans caused by viruses include influenza and hepatite A. Viruses are killed in pool water by filtration and sanitizing with a minimum level of disinfectant throughout the volume of pool water. Some types of fungis can cause diseases in humans. Coccidiosis and histoplasmosis are fungal diseases caused by inhaled spores that infect the lungs and other internal organs. Ringworm is an infection of the skin and nails caused by fungi and can be transmitted by direct contact with contaminated towels, combs or other shared items.

METHODS

For accurate bacteriological analysis, water samples should be processed as promptly as possible. Conditions can change after a number of hours of sample storage, so that samples may no longer be representative of conditions at the sampling site. The bacterial indicator organisms, like *Faecal coliforms*, are

particularly prone to “die-off” during storage (APFA, 1994; Bisson & Cabelli, 1979; Hoather, 1961). Standard Methods for the Examination of Water advise against delays longer than 6 hours between sample collection and sample incubation. The long distance between the laboratory and the widely scattered sampling sites thus preclude laboratory examination of water samples and necessitate field testing procedures.

SAMPLING

Six pools were selected and monitored twice a month over a certain period, from May 2008 to September 2008. The sites were located near the Tirana and Durres regions. Water samples were collected at the depth of 20-30 cm, and put directly into clean 1-litre plastic bottles. Microbiological analysis of water samples were started as soon as possible after collection to avoid unpredictable changes in the microbial population. When the samples could not be processed within 1 hour after collection, the samples were stored in an icebox and transported to the laboratory for analyses.

Faecal coliform (FC) and *Faecal streptococci* (FS) were enumerated, using the membrane filtration technique with Millipore field testing kits and incubators. Membrane enriched MF-C broth (Millipore) and incubation at 44,5^{o}C ± 0,5^{o}C for 24 hours was used for the determination of *Faecal coliforms*. *Total coliforms* and *Faecal coliforms* were determined by the membrane filtration method using M-Endo-Agar at 37^{o}C and on MFC Agar at 44^{o}C ± 0,5^{o}C for 48 hours, respectively. Testing was confined to the above mentioned organisms since it is generally recognized that these are the more reliable indicators of faecal pollution than the coliform group as a whole.

Fecal streptococci test: The feces of humans and animals contain large number of streptococcal bacteria that can be classified as belonging to the fecal streptococci group. To determine the presence or absence of coli-forms, we have also used the series of lactose broth tubes (Bisson & Cabelli, 1979; Bordner et al., 1978; Chamberlin & Mitchell, 1978).

Determination of *Chlamydia trachomatis* from eyes is performed through Direct Immunofluoreschent. Determination of *Candida albicans* is made by examination in microschop and at the same time from media Sabourand+ Chloramphenicol + Actidion. To determine the other *Candida* strains we have used mychotub “Roche” or API 20 AUX. Determination of *Staphylococcus* is performed by Staph-Check Kit, Lorne Laboratories LTD.

Water samples for *Helminthes* eggs determination were collected in non reactive borosilicate glass bottles of 500 ml capacity each, that had been cleansed and rinsed carefully, given a final rinse with distilled water and sterilized. Samples were taken from the river by holding the bottle near its base in the hand and plunging it, neck downward, below the surface. Then turning the bottle until neck

points slightly upward and mouth is directed toward the current. The sampling bottle was not filled up to the brim and 20mm to 30mm space was left for effective shaking of the bottle. We have used Epi-Info 2002 for statistical analyses.

RESULTS AND DISCUSSION

From the samples analyzed by us in the 6 locations, we have observed the data about the *Coliform total, Escherichia coli* and *Streptococcus faecalis* which are presented in the following charts (Fig.1, Fig.2, Fig.3).

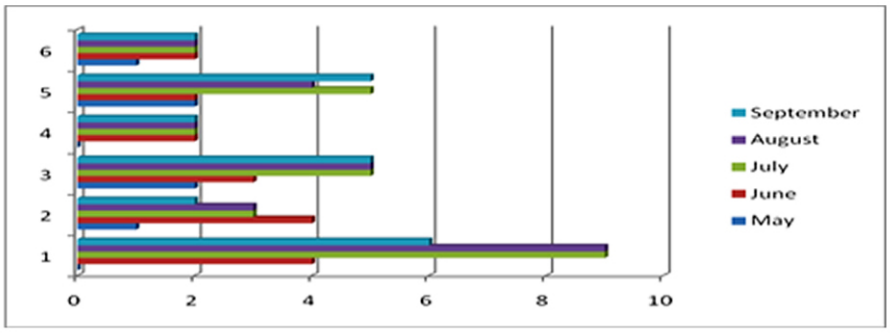

Figure 1: The distribution of *Coliform total.*

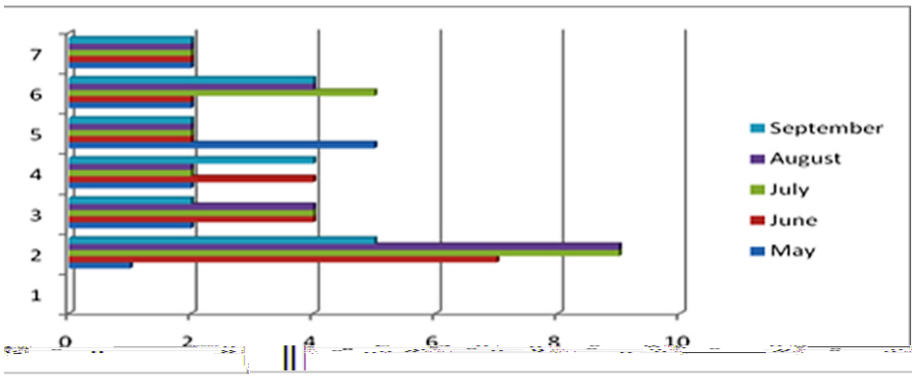

Figure 2: The distribution of *Escherichia coli.*

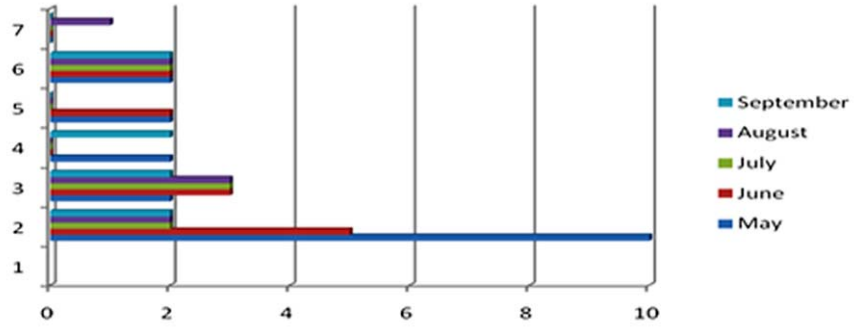

Figure 3: The distribution of *Streptococcus faecal.*

The pools were monitoried before and after the using of chlorine. After the using of the chlorine there was no data of the microbiological indicators.

We have analyzed 260 water samples from the pools in the entry and in the end. We stress that all the positive cases which are presented here are in the entry of the wells (Fig.1, Fig.2, Fig.3). FC/FS ratios greater than 4.0 indicate pollution derived from human wastes whilst FC/FS of 0.7 or less indicate pollution derived from livestock or poultry. For meaningful ratios, samples should be tested within 24 hrs of the pollution event, because of different rates of bacterial die-off. However, further research including microbiological typing is required before this assumption can be proved.

Even though a considerable number of wells failed to meet the stringent WHO (1984, 1993) guideline value for small untreated water supplies of 0 FC/100 ml, water with less than 20 or for the matter less than 50 FC/100 ml represents a considerable improvement in quality, compared to water from unprotected rivers and streams which normally contain in excess of 500 FC/100 ml .

From our samples most of them had the general microflora up to the reference value and were with *Total coliform* up to the allowed norms (Fig.1). The fecal indicators are higher than the referenced value. It's important to evaluate the indicators of sewage such as *Escherichia coli* (Fig.2) and *Streptococcus fecal* (Fig.3), which in our study are in high value. Coli form bacteria are organisms that are present in environment and in the faces of the warm-blooded animals and humans. Coli form bacteria will not likely cause illness. However, their presence in drinking water indicates that disease-causing organisms (pathogens) could be in the water system. Most pathogens that can contaminate water sources and water pools come from the feces of humans or animals. A number of bacteria can enter water via either point or nonpoint sources of contamination (Cabelli et al., 1976; Davies et al., 1995; Eugene et al., 1983). The bacterial index and the microorganisms are used to tell time after time that the water didn't fulfill the hygienic recommendation conditions.

Microbiological diseases are still transmitted in certain areas, in particular via drinking water and on recreational exposure to surface water. Apart from anthropogenic contamination of water, natural conditions may also make it unsuitable for different uses without extensive and costly treatment.

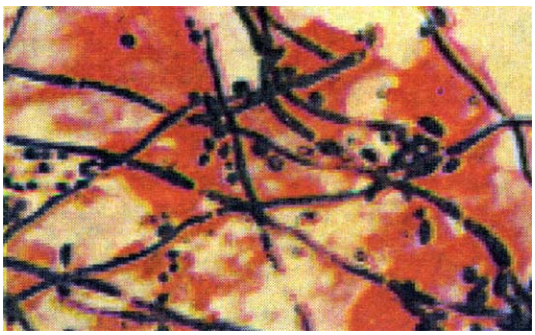

Figure 4: Pseudophylaments of *C. albicans.*

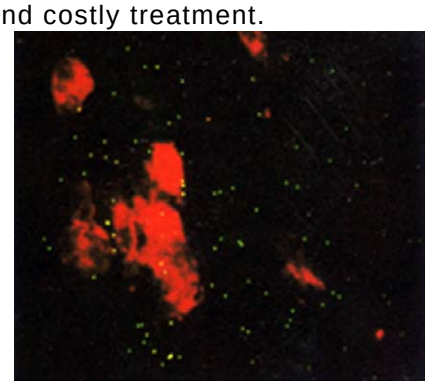

Figure 5: *Chlamydia* by Positive IF.

Table 1: The cases by *C. trachomatis* and *C. albicans* at the same time.

	C. tarchomatis		
C. albicans	**Pos**	**Neg**	**TOTAL**
Pos Row % Col %	72 13,8 50,0	448 86,2 65,7	520 100,0 63,0
Neg Row % Col %	72 23,5 50,0	234 76,5 34,3	306 100,0 37,0
TOTAL Row % Col %	144 17,4 100,0	682 82,6 100,0	826 100,0 100,0

From the people who are diagnosed with *Chlamydia trachomatis* and *Candida albicans,* CI 95% and OR =0,5 (0,36 , 075), 826 in total, the positive cases are 72 with both infections (Tab.1); 72 cases only by *Chlamydia trachomatis* (Fig.5); 448 cases by *Candida albicans* (Fig.4) and 234 negative cases.

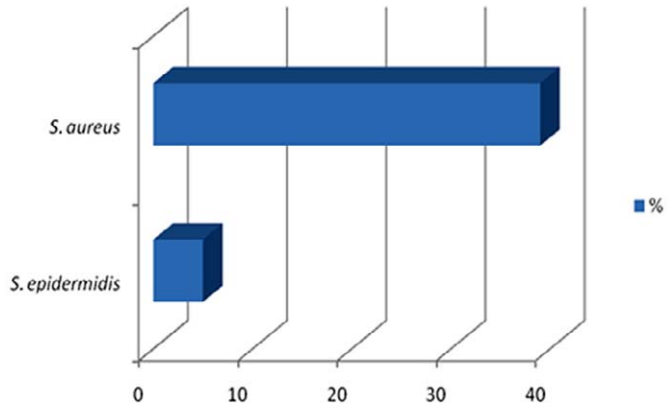

Figure 6: Percentage of the positive cases by staphylococcus.

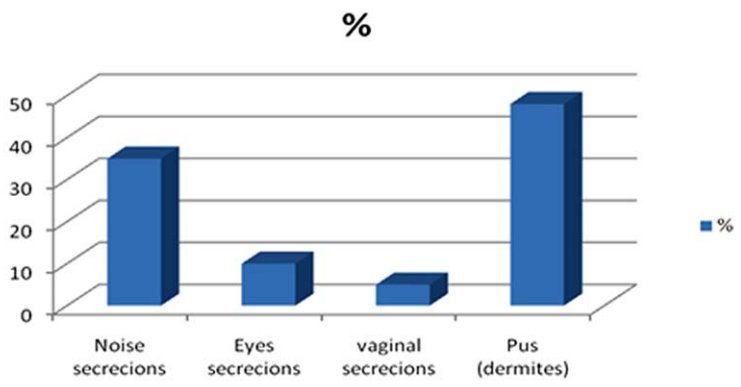

Figure 7: Percentage of the cases as samples sources.

From 122 cases only 48 or 39% are with *Staphylococcus aureus*; and 5% with *Staphylococcus epidermidis* (Fig.6).

Most of the cases are collected by pusses, because the staphylococcus are the best invader of the skin, and they multiply in the skin. It is important to place in account the conditions which they find in the derma.

In the same time we found a great percentage in noise secretions. Staphylococcus happened in 32%, because of the conditions on the nose mucus where the microorganisms was again multiplied, especially in the respiratory tract (Fig.7).

Swimming pool water is used from a number of people in Albania. So, it is necessary to evaluate (a) the environmental health indicators which will facilitate the evaluation of safe water access; (b) and other indicators such as: *enterococci, enteric viruses, coliphage, total culturable bacteria,* etc.

For the evaluation of safe water, apart of improvements of information regarding to swimming water quality of IHP, it is necessary to add new elements of environmental health indicators, according to World Health Organization's recommendations and methodology. It would be better to combine the microbiological examination with physic-chemical examinations.

Pollution of the surface of the swimming water is another reason why we are discussing this. Waste water and chemical wastes were also injected into deep wells, from which pollutant is constantly discharged. These pollutants can go into swimming pool, when the water that goes in them is supplied by wells, which are at the same time used to supply people with drinking water.

CONCLUSION

According to the World Health Organization's recommendations and methodology, in order to evaluate safe water, apart from improvements of information in regards swimming pool water quality of IHP, it is necessary to add new alements of environmental health indicators,

Our bacteriological qualitative tests of water were based on the identification of sewage indicators such as *Escherichia coli* and *Streptococcus faecalis*. Using proper media and procedures we have detected the presence of microorganisms. From these samples, the micro flora was up the reference, and the presence of total coli forms was above the reference value. We have also detected Staphloccocus, which has invaded to skin, nose secretions, etc. Additionally, we examined Clamydia especially in eyes, and many persons had mycosis signs, and we have determinate the Candida in the skin, etc.

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Original research article

Received: 06. July 2010.