BACTERIA SCREENING OF BLACK SEA BEACHES BY CONVENTIONAL AND ALTERNATIVE POLLUTION INDICATORS

V. Badea [1]*, M. Manea [1], D. P. Balaban [1], M. Grigorian [1] and C. Nuca [1]
[1] Ovidius University of Constanta, Romania - badea_victoria@yahoo.com

Abstract
Given that various infections can be caused by the contact with the sand beach and sea water, our study has been focused on identifying other pathogenic bacteria species, in parallel with fecal coliforms and fecal streptococci from Mamaia beach. Knowing the existence of other potentially pathogenic bacteria species found in the sand beach and sea water, is needed for the future enlargement of the conventional indicators list of beaches pollution. Our epidemiological data suggest that global bacteriological monitoring of the sea water and sand beach quality offers a better protection for the people who uses this recreational beaches.

Keywords: Pollution, Bacteria, Black Sea

Introduction
Recreational use of marine waters is increasing in many countries. It is widely accepted that water and sand beaches with high indexes of fecal contamination can be potential sources of contamination and contribute to the dissemination of bacterial resistance. Our study was based on analytic control of bacteria contamination in the sands and sea water samples collected from Mamaia beach by using conventional indicator standards, in parallel with other potential pathogens bacteria species.

Material and methods
Dry sand, wet sand and sea water samples were collected from three different areas of the Mamaia beach (from both ends and from the central part of the beach) between 1 January and 30 December 2012. Each sand sample consisted of 100 g of surface sand that was collected at a maximum depth of 2 cm using sterile bottle and spatula. Each sea water sample consisted of 100 mL sea water collected in sterile bottle that was analyzed according to standard filtered membrane method. Bacteria species were isolated, after their initial growth in plates with differential media (CLED, McConkey, Bile Esculin Azide Agar) and identified by using the following biochemical tests: API20 Staph, API20 Strep - bioMérieux, Rapid ID NF Plus for non-fermentative bacteria, Rapid ID ONE - Remel, for fermentative bacteria. The data were statistically analized by using SPSS 17. The correlations were considered significant for p-value <0.05.

Results and discussion
A total of 560 bacteria species were present in the samples. From quantitative point of view, total coliforms isolated in the sea water had normal concentration (< 100 CFU/mL) in all samples harvested from Mamaia beach [1], except the ones obtained from the area near the site of communication with Tabacarie lake, where higher proportion of fecal coliforms flora (sea water - 160 CFU/mL; dry and wet sand - 350 CFU/g) were identified. The most frequent bacteria species identified in all three types of examined samples are presented in Table 1.

Tab. 1. Bacteria species identified in sand and sea water on Mamaia beach

Samples		Dry sand		Wet sand		Sea Water		Total
		Value	%	Value	%	Value	%	Value
Bacteria Species	*Escherichia coli*	60	34,7	77	44,5	36	20,8	173
	Proteus Sp.	10	26,3	12	31,6	16	42,1	38
	Klebsiella Sp.	10	31,3	12	37,5	10	31,3	32
	Pseudomonas Sp.	2	22,2	2	22,2	5	55,6	9
	Enterobacter	4	13,3	6	20,0	20	66,7	30
	Citrobacter	2	11,1	8	44,4	8	44,4	18
	Serratia Sp.	5	15,2	10	30,3	18	54,5	33
	Enteroccocus Sp.	32	40,0	28	35,0	20	25,0	80
	Staphylococcus aureus	43	29,3	51	34,7	53	36,1	147

A high correlation was found between *E. coli* from the sand (wet and dry) and adjacent sea water (Chi square test; p<0.0001) [2]. In the same time, there is a high correlation between the presence of *E. coli* and *Staphylococcus aureus* identified in wet sand and sea water (p=0.006) and in dry sand and sea water (p=0.01). Also, higher contamination for all three types of samples, collected in the summer compared to those collected in the winter, demonstrates that the human contamination is an important source of bacterial pollution for the beach [2], [3]. The presence of *Staphylococcus aureus* in the dry and wet sand is the proof of mainly human contamination. In this order, identifying this bacteria species on the beaches is needed in the future, because it could prevent possible contamination with methicillin-resistant *Staphylococcus aureus* and the possible transformation of public beaches in an environmental reservoir of this bacteria species [4]. The idea of introduction of the alternative indicators for the evaluation of the bacteriological pollution of the beaches is sustained in the world also by other authors [5].

Conclusions
Knowing the level of contamination of sea water and sand beaches allows us to implement the necessary specific prevention measures against the diseases generated by the use of contaminated sand and sea water of the costal area. Identification on the beach sand and sea water of other potentially pathogenic bacteria species makes it necessary that for the future to extend the list of conventional indicators with the alternative indicators.

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