

EVALUATION OF THE SANITARY STATUS IN SOME BEACHES OF PORT-SAID
BY USING THE INDICATOR ORGANISMS.

BY

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Key words: Indicator organisms, Fecal coliform, Fecal streptococcus, Sanitary wastes.

ABSTRACT

Disposal of sanitary and industrial wastes into marine water may represent a health hazard especially in recreational areas. Periodic monitoring of the sanitary status of such areas is essential. The present study was aimed at evaluating, for the first time, six beaches along Port-Said coast using the two common indicators of fecal pollution, fecal coliform and fecal streptococcal counts. Both organisms were found in all samples tested. However, the counts of fecal streptococci were generally higher. Although bacterial counts were not indicating a high level of fecal pollution in the area, the studied beaches were divided into three different categories. The fishing club, Marhaba and Saleh Seleem showed the highest counts, Port Foad moderate and Ashtoom El-Gameel and El-Deeba the least counts.

INTRODUCTION

During recent years, the disposal of sanitary and industrial wastes into marine and fresh water has represented a common sanitary problem in many countries since it is the easiest and most economic method (W. H.O., 1977). Recreational water quality plays an important role in the maintenance of public health (Morrison, 1984). Health hazards associated with direct contact with water include diseases transmitted by potentially pathogenic and pathogenic microorganisms. Among diseases related to swimming in contaminated areas are typhoid, paratyphoid, cholera, hepatitis, poliomyelitis, bacterial and fungal skin infections and swimmers itch (Seyford et al., 1985).

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Microbiological methods applied to indicate the degree of water contamination are based on the detection of excretal indicator organisms rather than pathogens. Such indicator organisms are regarded by the W.H.O. and A.P.H.A. as the best available tools for testing the bacteriologic quality of water, their presence indicates fecal pollution (A.P.H.A., 1980).

Recreational areas along Port-Said beaches have not been tested before for contamination by enteric pathogens. In this study six representative beaches were selected and tested over a one year period for the presence of indicators of sewage pollution.

MATERIALS AND METHODS

This study was carried out from June (1992) to May (1993) on six selected beaches along Port-Said shore: The fishing club, Marhaba, Saleh Selim, Ashtoom El-Gameel, El-Deeba and Port-Foad, Figure (1).

A total of 216 water samples were collected from these six beaches. They were collected at locations and time of greatest bathing load at the level of lower chest height (about one meter depth) and about 20 cm below water surface.

The laboratory procedures followed in this study were those described by the standard methods for examination of water and waste water (A.P.H.A., 1980). Fecal coliforms and streptococcal counts were determined as indicators of fecal pollution by using the membrane filter technique. Millipore membrane filter type MA-pore size 0.45/μ, diameter 47 mm was used (cat. No. A045 H047A. Lot No. B 25/3).

RESULTS

Table (1) shows that for fecal coliforms during summer months there was a statistical difference between different beaches ($F = 6.83$, $P < 0.05$), but no significant difference between the months ($F = 3.43$, $P < 0.05$). Ashtoom El-Gameel and El-Deeba showing the least counts, Port Foad moderate count, whereas the fishing club, Marhaba and Saleh Selim had the highest counts.

In cold months there was no statistical differences between different beaches ($F = 1.01$, $P > 0.05$) or different months ($F = 0.99$, $P > 0.05$).

In Spring months: there was significant difference between the beaches ($F = 7.49$, $P < 0.05$) but no significant difference between months ($F = 1.20$, $P > 0.05$). Saleh Selim had the highest counts during these months.

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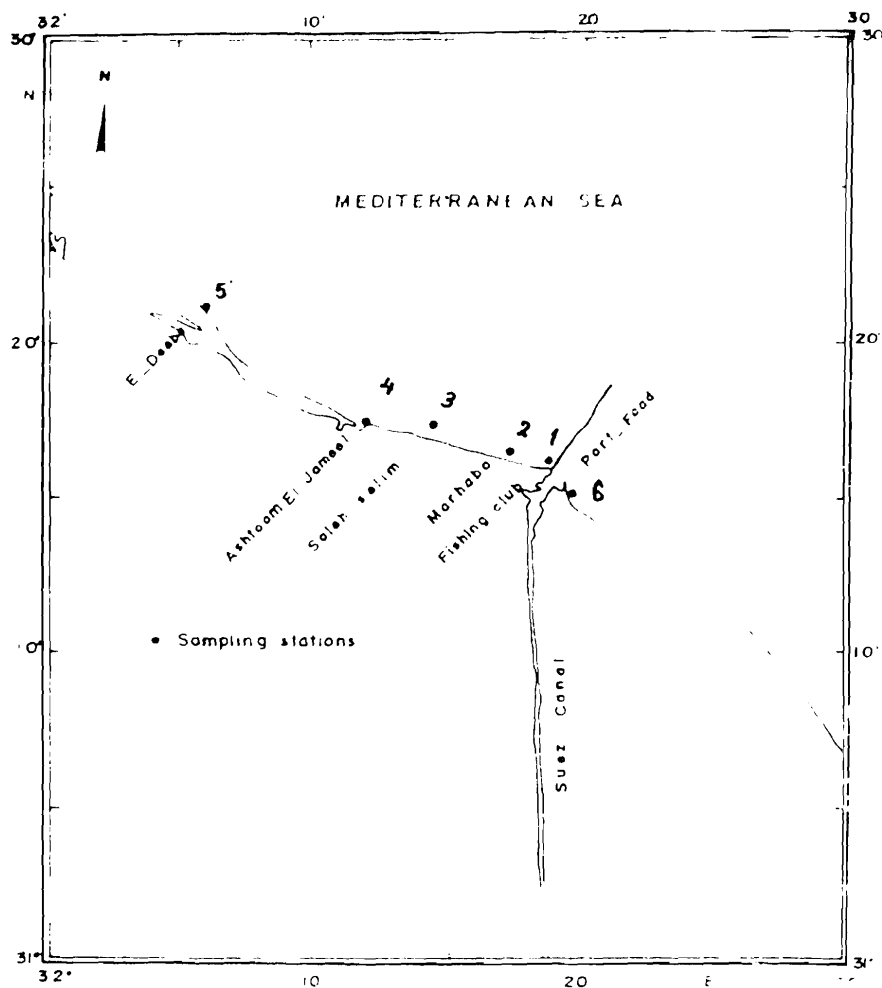


Figure 1 Location map of the study area.

Table (2) shows that for fecal streptococci during summer months there were differences but not significant; July seems to be the highest one. As for different beaches the difference was significant. The fishing club showed the highest count whereas Ashtoom El-Gameel and El-Deeba showed the lowest counts

In cold months Saleh Selim showed the highest count and was significant from other beaches. In Spring months however the difference between beaches and months was not significant

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Table VIII: The arithmetic means (\bar{x}), square root of the means, and analysis of variance of fecal coliforms counts of the six studied Port Said beaches during Summer, Autumn/Winter and Spring Months.

No	Beaches	Summer Months			Autumn/Winter Months			Spring Months							
		arithmetic means	Square root of the mean	June July Aug. Sept.	arithmetic means	Square root of the mean	Oct. Dec. Jan. Feb.	arithmetic means	Square root of the mean	March April May					
1	FISHING-STATION	145	57	48	66	8.66	147	85	79	120	10.30	483	136	84	14.18
2	MARJARA	135	40	41	61	8.04	109	59	68	130	9.44	343	542	307	17.93
3	Saïeh Seïm	224	37	142	111	9.92	90	59	81	235	10.33	537	564	557	24.74
4	Asrtoom El-Cameel	30	40	41	57	6.44	51	48	70	65	7.62	138	129	84	10.76
5	El-Zeiba	36	30	32	95	6.72	91	72	75	50	8.44	84	324	84	12.11
6	Port Fouad	49	65	111	112	8.88	57	71	152	50	8.84	255	154	129	13.24

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Table (2): The arithmetic means (\bar{x}), square root of the means, and analysis of variance of fecal streptococci counts of the six studied Port Said beaches during Summer, Autumn/Winter, and Spring Months.

No.	Beaches	June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Jan.		Feb.		March		April		May	
		Arithmetic means	Sqr. root	Arithmetic means	Sqr. root	Arithmetic means	Sqr. root	Arithmetic means	Sqr. root	Arithmetic means	Sqr. root	Arithmetic means	Sqr. root	Arithmetic means	Sqr. root	Arithmetic means	Sqr. root	Arithmetic means	Sqr. root	Arithmetic means	Sqr. root	Arithmetic means	Sqr. root	Arithmetic means	Sqr. root
1	Fishing-club	445	6850	3400	3975	55.87	806	995	640	1800	31.91	1000	1033	1645	34.77										
2	Marhaba	2340	3475	355	4650	48.59	1040	1005	585	600	28.17	1744	1848	770	37.50										
3	Saleh Selim	5750	3750	506	4650	56.94	1545	1220	840	2400	38.05	1340	1440	1645	38.57										
4	Ashtoom El-Gameel	268	595	335	595	23.78	1380	465	305	500	24.64	872	872	1250	31.47										
5	E.-Deeba	535	250	280	755	20.79	1020	410	400	1200	26.70	1556	1400	330	31.38										
6	Port Poad	4950	2450	1783	785	47.52	1575	835	415	500	27.82	1744	1000	740	33.53										
Source of Var.		DP	Sum of Sqr.	Mean	Sqr.	Var. Ratio	DP	Sum of Sqr.	Mean	Sqr.	Var. Ratio	DP	Sum of Sqr.	Mean	Sqr.	Var. Ratio									
Between beaches		5	41661253.0	8332250.6	3.18	5	1876367.8	375273.55	2.28	5	5745974.7	1149194.9	3.44												
Between months		3	10269665.0	3423221.7	1.31	3	1893040.1	631013.37	3.83	2	5507590.9	2753795.4	8.26												
Residual		15	39311477.0	3423221.7	15	2468813.1	164587.54	10	3335213.4	333521.34															

Tables (3) and (4) show that for both indicator organisms there was a significant difference between the three seasons.

Figure (2) and (3) represent the arithmetic mean (\bar{X}) of both organisms in the different seasons. Fecal streptococci generally showed much higher counts than fecal coliforms. The fishing club, Marhaba and Saleh Seleem showed higher bacterial counts especially fecal streptococci in summer months.

Table (3): The arithmetic means, square root of means, and the analysis of variance, of the fecal coliforms counts of the six studied Port-Said beaches during Summer, Autumn/Winter, and Spring Months.

No.	Beaches	Summer Months	Autumn/winter Months (\bar{x})	Spring Months (\bar{x})	Square root of the mean (\bar{x})
1	Fishing-club	79	107	232	11.49
2	Marhaba	69	91	403	12.64
3	Saleh Selim	103	116	613	15.23
4	Ashtoom El-Gameel	42	58	117	8.30
5	El-Deeba	48	72	164	9.41
6	Port Foad	82	82	179	10.49

Table (3): cont.

Source of Var.	DF	Sum of Sqr.	Mean Sqr.	Var. ratio
Between beaches	5	84234.28	16846.856	1.70
Between months	2	169942.11	84971.057	8.60
Residual	10	99109.84	9910.989	

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Table (4): The Arithmetic means, square root of the means and the Analysis of variance, of the Fecal Streptococci counts of the six studied Port Said beaches during Summer, Autumn/Winter and Spring months.

No.	Beaches	Summer Months	Autumn/winter Months (X)	Spring Months (X)	Square root of the mean (X)
1	Fishing-club	3617	1060	1226	42.57
2	Marhaba	2705	807	1454	39.52
3	Saleh Selim	3664	1501	1475	45.89
4	Ashtoom El-Gameel	448	662	998	26.16
5	El-Deeba	455	757	1095	27.31
6	Port Foad	2492	831	1161	37.61

Source of Var.	DF	Sum of Sqr.	Mean Sqr.	Var. ratio
Between beaches	5	5745974.7	1149194.9	3.44
Between months	2	5507590.9	2753795.4	8.26
Residual	10	333521.4	333521.34	

From Table (5) it could be seen that the FC/FS ratio was low, (less than 0.2), for most of the beaches; the highest being (0.4) in Saleh Seleem in Spring months.

Table (5): Fecal Coliform to Fecal Streptococci ratio (Fc/Fs) during Summer, Autumn/Winter and Spring Months.

No. Beaches	Summer Months	Autumn/Winter Months	Spring Months
	Fc/Fs	Fc/Fs	Fc/Fs
1 Fishing-club	0.02	0.10	0.19
2 Marhaba	0.02	0.11	0.28
3 Saleh Selim	0.03	0.10	0.41
4 Ashtoom El-Gameel	0.10	0.10	0.12
5 El-Deeba	0.10	0.10	0.15
6 Port Foad	0.03	0.10	0.15

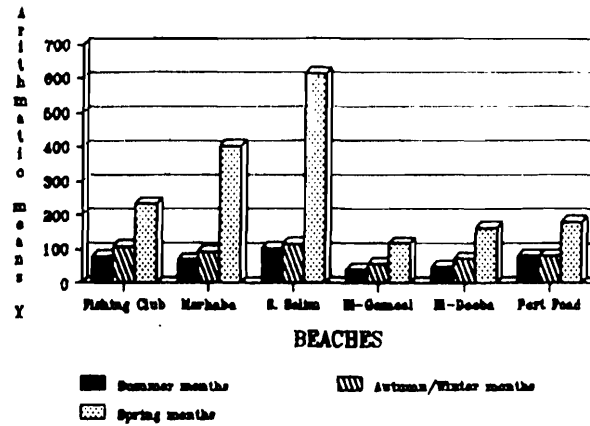


Figure 2: The arithmetic means (X) of the fecal coliform counts of the six studied Port-Said beaches during 1992/93.

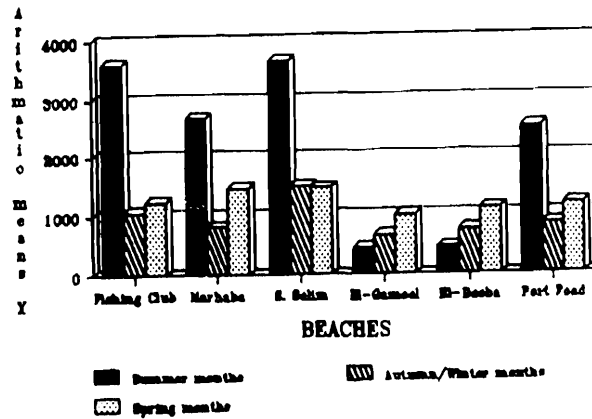


Figure 3: The arithmetic means (X) of the fecal Streptococci counts of the six studied Port-Said beaches during 1992/93.

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DISCUSSION

The present study revealed that the two employed indicator organisms (Fecal coliform and fecal streptococci) were found to exist in all samples with varying degree of fecal pollution from one beach to the other.

It must be stated however, that the degree of pollution detected is by far lower than that reported for beaches in other cities such as Alexandria (Rakha et al., 1987; El-Sharkawi et al., 1976).

If we were to categorize these beaches into different groups according to their degree of pollution (El-Sharkawi et al., 1976 and El-Ghoroury, et al. 1983) then Ashtoom El-Gameel and El-Deeba would be the least polluted, Port Foad represents moderate bacterial counts whereas fishing club, Marhaba and Saleh Selim had the highest bacterial count, indicating higher degree of pollution.

Saleh Seleem, Marhaba and the Fishing club which showed the highest degree of pollution represent the most crowded beaches in the area. El Gameel and El Deeba which gave the lowest indication of pollution have the least number of swimmers. This result shows that there is a direct relation between the number of swimmers and the bacterial counts as the counts were high in summer and spring seasons were the number of swimmers is high.

Although Ashtoom El Gameel has a sewer outfall, its bacterial count is low. This may be due to the fact that when the level of the open sea is higher than that of the outfall a continuous dilution of the discharge occurs. However, when the level of open sea is lower than the sewer outfall, the water current directs the discharge in the direction of Saleh Seleem, Marhaba and up to the fishing club. There are no swimmers in this area so summer months show no increase in bacterial counts.

In the present study, it was observed that the fecal streptococci count was higher than that of fecal coliform in almost all the samples tested. This is in agreement with the observation reported by Rakha et al., 1987. This may be due to the fact that fecal streptococci are salt tolerant organisms and therefore could survive much longer than fecal coliforms in sea water (Evison, 1978).

As for the ratio of fecal coliforms (FC) to fecal streptococci (FS), our results showed a low FC/FS ratio, this may be attributed to the concentration of salt, unfavorable water, pH and toxic metal ions such as copper (El-Molla et al., 1981)

Although the present study does not indicate a high level of pollution of the bathing beaches of Port Said, it is the first record of bacteriological evaluation of pollution in the area. Several factors should be taken into consideration to prevent any future increase in pollution in the area. This

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includes pre-treatment of sewage disposed of into the beaches by chlorination or any other suitable means and periodic bacteriological survey of the area to monitor the level of pollution at different intervals.

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