



# Recreational Marine Water Samples And Its Relationship With Acute Gastroenteritis (AGE) Case Reporting In Port Dickson District, Negeri Sembilan, Malaysia



Ministry of Health Malaysia

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## Introduction:

Recreational marine water sample surveillance activity is routinely done by coastal districts and a few markers such as faecal coliform and enterococci spp. level were routinely measured to represent the magnitude of enteric bacteria pollution in marine water. Whereby Acute Gastroenteritis (AGE) is an illness characterized by gastrointestinal symptoms such as diarrhoea, vomiting and abdominal pain which is mainly caused by infection of the enteric pathogen to the gastrointestinal system. Due to both surveillance systems being related to enteric pathogens and their associated illness, there is a need for us to unravel the potential relationship between marine water sample parameters and local district Acute Gastroenteritis (AGE) data surveillance. This study aimed to explore the relationship between marine water sample parameters and Acute Gastroenteritis (AGE) surveillance data in Port Dickson district.

## Objectives:

- To explore the relationship between marine water sample parameters and Acute Gastroenteritis (AGE) surveillance data in Port Dickson district.

## Method and material:

- This is a cross-sectional analysis.
- Marine water samples' data surveillance was obtained from the environmental health unit, Port Dickson Health District. Marine water sampling was done at 2 main recreational beaches in Port Dickson namely beach "A" and beach "B", which is 2km apart. (figure 1 & 2)
- Water sampling procedure was done in 3 spots located around 20 meters from the monsoon drain outlet near the beach. Average reading was taken based on sampling from 3 spots on each beach.
- Recreational marine water Sampling was done monthly throughout the year 2022-2023 and parameters such as enterococci, faecal coliform, pH and turbidity level were recorded.
- Enterococci and faecal coliform level were measured in count/100ml, whereas turbidity level were measured in NTU (Nephelometric Turbidity Units).
- AGE case reported was obtained via AGE surveillance data. Specifically, data was collected via weekly case reporting from the hospital and all health clinics in Port Dickson district throughout the year 2022-2023 which were recorded by the communicable disease control unit, Port Dickson Health District Office.
- Correlation analysis has been made between recreational marine water samples parameters with: AGE cases reporting during that week, AGE cases in 1&2 week before and 1&2 week after, 3 weeks' average AGE cases, and monthly average AGE cases.
- Action level is defined by having AGE case above epidemic line (3 years average + 2 standard deviation)
- Rainy season is defined by (3) months with highest precipitation in a year in Port Dickson which are October, November, and December.
- Data was analysed using SPSS version 23; Pearson correlation was used for correlation analysis, t-test was used to compare mean, Fisher exact test for crosstab analysis.

## Result & Discussion

Table 1: correlation analysis between marine water parameters with AGE case reporting for 2 main beaches in Port Dickson.

Variable	Beach A		Beach B	
	p-value	r-value	p-value	r-value
<b>Enterococci</b>				
AGE cases that week	0.502	-0.181	0.883	-0.04
AGE cases-1 week	0.861	0.068	0.464	0.197
AGE cases-2 week	0.058	0.483	0.068	0.467
AGE cases after 1 week	0.519	-0.174	0.414	0.220
AGE cases after 2 week	0.664	-0.118	0.527	0.171
AGE cases 3 weeks' mean	0.834	-0.057	0.395	0.228
Mean AGE cases that month	0.726	-0.095	0.446	0.205
Beach A vs Beach B	<b>0.004</b>	<b>0.678</b>		
<b>Faecal coliform</b>				
AGE cases that week	0.286	-0.284	0.208	-0.333
AGE cases-1 week	0.927	-0.025	0.807	-0.066
AGE cases-2 week	0.085	0.444	0.063	0.476
AGE cases after 1 week	0.432	-0.211	0.393	-0.229
AGE cases after 2 week	0.681	-0.112	0.980	0.007
AGE cases 3 weeks' mean	0.609	-0.139	0.536	-0.167
Mean AGE cases that month	0.579	-0.150	0.690	-0.108
Beach A vs Beach B	<b>&lt;0.001</b>	<b>0.797</b>		
<b>pH</b>				
AGE cases that week	0.058	-0.482	<b>0.034</b>	-0.533
AGE cases-1 week	0.927	-0.372	0.130	-0.395
AGE cases-2 week	0.085	-0.257	0.180	-0.353
AGE cases after 1 week	0.060	-0.490	0.121	-0.403
AGE cases after 2 week	<b>0.036</b>	-0.528	0.123	-0.402
AGE cases 3 weeks' mean	<b>0.018</b>	-0.583	<b>0.045</b>	-0.507
Mean AGE cases that month	<b>0.005</b>	-0.663	<b>0.009</b>	-0.630
Beach A vs Beach B	<b>&lt;0.001</b>	<b>0.776</b>		
<b>Turbidity</b>				
AGE cases that week	0.747	0.088	0.627	0.132
AGE cases-1 week	0.581	0.149	0.628	0.131
AGE cases-2 week	0.071	0.115	0.640	0.127
AGE cases after 1 week	0.651	0.122	0.736	0.093
AGE cases after 2 week	0.441	-0.207	0.349	-0.251
AGE cases 3 weeks' mean	0.524	0.172	0.546	0.163
Mean AGE cases that month	0.904	0.033	0.855	0.050
Beach A vs Beach B	<b>&lt;0.001</b>	<b>0.954</b>		

Table 2: marine water parameters comparison in rainy season

Variable (N=16)	mean	Mean difference	t	p	CI
<b>Mean Enterococci level</b>					
Beach A Rainy season	354.166	-85.583	-2.201	0.044	-1007.9-836.7
Yes	439.750				
No					
Beach B Rainy season	419.17	-49.444	-0.122	0.908	-1076.5-977.6
Yes	468.61				
No					
<b>Mean faecal coliform level</b>					
Beach A Rainy season	1705.000	-80.083	-0.052	0.960	-3741.3-3581.8
Yes	1785.083				
No					
Beach B Rainy season	379.333	-2012.11	-2.402	<b>0.035</b>	<b>-3851.2 - (-472.3)</b>
Yes	2391.44				
No					
<b>Mean pH level</b>					
Beach A Rainy season	7.526	-0.125	-0.812	0.434	-0.463-0.212
Yes	7.651				
No					
Beach B Rainy season	7.418	-0.178	-0.699	0.527	-0.84-0.484
Yes	7.596				
No					
<b>Mean turbidity level</b>					
Beach A Rainy season	20.739	8.729	0.626	0.572	-33.7-51
Yes	12.010				
No					
Beach B Rainy season	24.059	11.618	1.079	0.352	-20-43.8
Yes	12.440				
No					

- Marine water samples throughout the year 2022-2023 showed that faecal coliform levels were above permissible level (>1000 count/100ml) in February, March, July and August for both beach, whereas Enterococci level was above permissible level (>230 count/100ml) in February, August and October (1).
- AGE case reported that week was significantly correlated with the mean pH level in the marine water sample (beach B) in a negative linear relationship ( $p=0.034$ ,  $r=-0.53$ ). The mean pH level between beach A and beach B was significantly correlated in a positive manner ( $p<0.001$ ,  $r=0.78$ ). Faecal coliform level in marine water samples between beach A and beach B were also significantly and positively correlated ( $p<0.001$ ,  $r=0.8$ ), and positive linear relationship was also detected in marine water Enterococci level between beach A and beach B. (Table 2)
- Although a correlation was reported between AGE and other recreational water body enterococcus level in other studies (2,3), no correlation was detected between AGE cases reported and the mean faecal coliform level or mean Enterococci level in water samples.
- Enterococci and faecal coliform levels were also not correlated with marine water's pH level nor marine water's turbidity level. The rainy season was associated with lower faecal coliform level in beach B (table 3). On top of that, having AGE cases reported above action level in the month before was associated with higher marine water enterococci levels in the following month ( $p=0.038$ ).

**Conclusion:** Result show that AGE cases reported in Port Dickson district were not associated with marine water Enterococci or faecal coliform level but otherwise it did correlate negatively with marine water pH level. Since this analysis did not include other enteric pathogens such as viruses and other bacterial species that may be associated with AGE, more information is needed to fill the gap in establishing the relationship between these data



Figure 1: beach "A" sampling site



Figure 2: Beach "B" sampling site