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Cellular Immunity of River Water Consumers and Bandarmasih Municipal Waterworks Consumers

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ABSTRACT

The quality of water used for daily needs affects human health. Some people in Banjarmasin use the PDAM Bandannasih water and some use Manapura River water. One of the infection signs is the increases of white blood cell, includes neutrophil, monocyte, eosinophil and lymphocyte. The aims of this study was determine the differences of neutrophil, monocyte, eosinophil and lymphocyte count between Manupum river water consumers and Bandannasih Local Water Supply Utility consumers in Banjarmasin. This study was an analytical observational with a cross sectional approach. Sample selection used purposive sampling technique. The result showed that neutrophil, monocyte, eosinophil and lymphocyte count average level of 30 consumers of Martapura River water were 54.03%, 7.43%, 3.2%, 34.8%, respectively; and neutrophil, monocyte, eosinophil and lymphocyte count average level of 30 consumers of Bandannasih Local Water Supply Utility was 54.9%, 7.53%, 4.39%, 32.8%, respectively. Statistical analysis with unpaired t-test showed that there wasn't any difference of neutrophil, monocyte, eosinophil and lymphocyte count between Manupum River water consumers and Bandannasih Local Water Supply Utility consumers ($p=0.723$, $p=0.822$, $p=0.623$, $p=0.318$) in AUBUSI 2018 period.

Keywords: river water consumers, local water supply consumers, immunity, leukocytes

Introduction

The river flow in the Province of South Kalimantan, especially the City of Banjarmasin, is used for various activities. The percentage of river water use by the people of the Alak River to clean their houses is 95%; to water the plants 92%; to bath 77%; to wash the clothes, the cooking utensils, and the eating utensils 74%; and for other activities 1%.

The more the activity of the people on the riverside grows, the higher the level of pollution in the water due to the direct household waste thrown away to the water. The huge amount of waste disposal into the river will make the quality of water worse. As many as 34% of the people around the river in Banjarmasin throw feces directly into the river and 64% use traditional septic tank (cibfok) that do not meet the requirements of good sanitation, causing the surrounding environment to be polluted. It is very

possible to find many bacteria, viruses, and parasites in polluted water. The bacteriological test of river water in Banjarmasin, Daritokuala showed that the MPN values of *Coliform* and *E. Coli* are respectively 29 and 0 MPN/100 ml. The MPN value of *Coliform* dropped to 18 MPN/100 ml in the river water which has been given alum.

Another cause of river water pollution in the city of Banjarmasin is the disposal of domestic waste and factory waste into the river. As the population increases, the efforts to fulfill the water needs are increased through the Local Water Company (PDAM). The clean water in the city of Banjarmasin is supplied by the PDAM Bandarmasih through the process of coagulation-flocculation, filtration, sedimentation and disinfection. Chlorine is a disinfectant commonly used by PDAM. This substance is capable of killing pathogenic bacteria and protozoa in the water and inhibiting the growth of moss. The existence of free chlorine compound in the distribution of water regulated by PERMENKES 2010 is 0.2-0.5 mg/l.

The microbiological quality of water provided by PDAM Bandarmasih is proven to be good through the analysis of the quality of customers' clean water of Water Treatment Plant (IPA) zone 1 PDAM Bandarmasih on

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the period of June-July 2018, the amount of *E. Coli* and the total of *Coli* is 0 per 100 ml of water in the sample that meets the drinking water requirements.*

Neutrophils together with monocytes are phagocytic cells and are the first immune cells to respond during infection to fight bacteria.⁹ Eosinophils play a role in allergic and parasitic infections.¹⁰ Whereas lymphocytes are able to produce the body's defense components

against foreign objects that have been specifically identified. There are B lymphocytes that function in humoral immunity and produce antibodies in the blood.

and T lymphocytes as cellular immunity that does not produce antibodies, but works directly to destroy specific foreign objects with chemicals.¹¹

The poor water quality, especially microscopically, increases the risk of infection for its users, one of which is an increase in the number of leukocytes. Based on the description above, a study was conducted to determine the differences in the number of neutrophils, monocytes, lymphocytes and eosinophils of Manapura River water users with water users of PDAM Bandarmasih.

Research Materials and Method

The implementation of this study was using an observational analytic cross sectional method. The population of this study is the people using the water from Manapuro River on Ray Street 17 RT.02 Bcrangas District with a total population of 155 people and the people using the water from PDAM Bandarmasih on Maluku Street RT.05 Pasar Lama District with a total population of 176 people for daily needs in Banjarmasin City in August 2018.

Results

The Shapiro-Wilk test showed that the data on the number of neutrophils and lymphocytes of river water user group and PDAM water user group spread out normally. The data on the number of eosinophils and monocytes were not normally distributed, hence data transformation was carried out. After all data were normally distributed, it was followed by hypothesis testing with unpaired t, the results showed that there were no statistically significant differences in the number of neutrophils, monocytes, lymphocytes and eosinophils between the two groups of research subjects with p values of 0.723, 0.822, 0.623 and 0.318.

Table 1: Characteristic of Respondents of Water Users of River on Ray Street 17 and Water Users of PDAM Maluku Street in August 2018 according to Gender, Range of Age, Current Disease History (RPS), Drug Consumption History and Neutrophil Levels

Category	Group			
	Water User of River		Water User of PDAM	
1 Gender				
Female	19	63.3	23	76.7
Male	11	36.7	7	23.3
2 Range of Age (year)				
18-31	5	16.7	3	10
32-46	13	43.3	18	60
47-60	12	40	9	30
3 Current Disease History (RPS)				
Pam	2	6.66	2	6.66
Hypertension	0	0	1	3.33
Hypercholesterol	0	0	1	3.33
Anemia	0	0	1	3.33
Diabetes mellitus	0	0	2	6.66
4 Drug Consumption History				
Antihipertensi	4	13.33	1	3.33
NSAID	2	6.66	2	6.66
Anticholesterol (statins)	0	0	4	13.33
Contraception (birth control pill)	2	6.66	2	6.66
Antipyretic	1	3.33	1	3.33
Ulcer medication (antacid & H2-receptor antagonist)	2	6.66	3	10
Chlorpheniramine maleic	1	3.33	1	3.33
Anti gout	0	0	1	3.33
Antihyperglycemic	0	0	2	6.66

Table 2: Results of Laboratory Test of Water from PDAM Bandarmasih on Maluku Street, RT 05, Banjarmasin and Water from Marlapura River on Ray Street 17, RT 02, Beraegas "with and "without Alum

Parameter	Maximum Limit	River Water	River water with Alum	PDAM water
1. Physics				
Color	≤15	19.7	2	5
Turbidity(NTU)	≤5	84.6	0.1	1.27
Temperature (C°)	Air temperature ± 3	26.9	26.9	26.5
2. Chemicals				
Chlorine(mg/L)	≥-2	-	-	0.82
Aluminium (mg/L)	6.5-8.5	0.55	1.25	-
Iron (mg/l)	1.0	2.24	0.09	-
Mend (mg/l)	0.2	0.38	0.1	-
3. Bacteriological				
Coli (MPN/100 ml)	0	0	0	0
MPN Coli (MPN/100 ml)	0	50	18	0

Table J: Average Number of Neutrophils, Monocytes, Lymphocytes and Eosinophils in Respondents of Water Users of River on Ray Street 17, RT 02, Berangas and Water Users of PDAM Bandarmasih on Maluku Street, RT 05, Banjarmasin in the Period of August 2018

#	Category	Group of User Respondent			
		Marlapura River Water		PDAM Water	
		N	%	N	%
1. Monocytes					
	Average	30	7,43	30	7.54
	Normal	20	6,36	18	6.28
	Monocytosis	10	9,57	12	9A
	Monocytopenia				
2. Neutrophils					
	Average	30	54,03	30	54.9
	Normal	19	57,2	18	59.25
	Neutropenia	9	42.3	11	46.2
	Neutrophilia	2	77		72.6
3. Eosinophils					
	Average	30	3,21	10	4,39
	Normal	14	2.8	9	3
	Eosinopenia	9		9	1.2
	Eosinophilia	7	7	12	7.9
4. Lymphocytes					
	Average	30	34.8	30	32.8
	Normal	19	31.4	21	31
	Lymphocytosis	9	46	5	42.5
	Lymphocytopenia	2	17.5	4	22.7

Discussion

The average number of each cell type is almost entirely within the normal range, both in the group of the river water users and the groups of the PDAM water users. Only the average number of eosinophils of PDAM water users has increased from the normal value (4.39-!). The statistical results showed that there were no significant differences in the number of neutrophils, monocytes, lymphocytes and eosinophils between the two groups of respondents. This could be due to the two groups of respondents giving direct treatment of water to be used, namely deposition, alum and boiling which could interfere with the sustainability of the pathogenic bacteria in the water thereby reducing the risk of infection for users. In addition, the use of soap, toothpaste and other cleaning agents can kill pathogenic microorganisms because they are antibacterial.

The river water used by the people on Ray Street 17, Berangas for daily activities, especially kitchen needs is always accommodated and given the alum which functions as a flocculator where its activities are to agglomerate pollutants such as industrial residues, metals, and microorganisms and are known also as an antibacterial. Alum can inhibit the bacterial growth. The concentration of alum as much as 1% makes gram-positive bacteria experience a death phase, and the concentration of 2% causes the death of gram-negative bacteria.

The disposal of soap and detergent waste into the river results to a worse quality of river water. However,

alum can reduce detergent levels by absorbing dyes and other pollutants, and alum is effective in reducing iron levels in water.

Particularly for drinking water, besides being given alum, it can also be boiled. The bacteria and the other pathogens in the water that go through a cooking process to 100°C for 5-10 minutes will disappear."

Maluku Street, Pasar Lama are fulfilled with the water from PDAM Bandannasih. The water has been given chlorine as a disinfectant. The results of quality test of PDAM water (table 2) are in accordance with the standard, where one of the indicators, known as the value of water turbidity, is not more than 5 NTU. It is because the high value of turbidity will reduce the disinfection activity during the processing of water purification.¹⁵ The disinfection will work effectively if the free chlorine in the water amounts to between 0.2-0.5mg/l, if the disinfection is less, it will not be effective, and if it is more, it will be carcinogenic."

The disinfection process of water from PDAM Bandarmasih is proven to be good, according to the lab results in June 2018 showing that the MPN values of *Coliform* and *E. Coli* are 0 per 100 mL.¹¹ Therefore, the water flow that reaches the people's houses is of good quality and free of pathogenic microorganisms. This is in accordance with the results of the study that the average number of neutrophils, monocytes and lymphocytes using PDAM water on Maluku Street, RT02, Banjarmasin is in the normal range.

In addition to the direct treatment of water used, people in both locations also use soap for bathing, washing dishes and other eating utensils, and toothpaste for brushing their teeth. One of the ingredients contained in toothpaste is flour which is antibacterial. The use of toothpaste with flour has been proven to be effective in killing bacterial colonies.^{11,12} The antibacterial content found in toothpaste is baking soda (sodium bicarbonate). Baking soda is alkaline which can neutralize the pH of the oral cavity, so that it can inhibit the bacterial metabolic activity. Baking soda also has hypertonic activity which later results in hypotonic content of water-losing bacteria which will make the bacterial cells become dehydrated and can eventually destroy the bacteria.^{13,14}

Ordinary soap (not antibacterial) can reduce 50% of pneumonia in infants and 53% of diarrhea in children

under 15 years old. And there is no significant difference between antibacterial soap and ordinary soap in its effectiveness in killing bacteria."

Although there were no statistically significant differences between the neutrophil counts of the two groups of respondents, there were variations in the number of respondents between the two groups of respondents. This was probably due to the differences in the environmental characteristics of the two research locations. Maluku Street is a market area with dense environmental characteristics. The houses and the merchant stalls are located side by side on both sides of the road with a large number of local people and market visitors. An environment with a huge amount of population and a minimum amount of air ventilation can increase the density of germs or bacteria.¹¹ The people around such location have a higher risk of exposure to bacteria. Meanwhile, on Ray Street (7, Brangas District, it looks cleaner.

Gender also affects the number of leukocytes. In this study, the number of female respondents in the group of river water users (19 people) was less than the female respondents in the group of PDAM water users (23 people). The immune response of women is faster to respond to infection compared to the immune response of men. When an infection occurs, a woman's immune system recognizes and destroys pathogens that enter the body more quickly than men.¹⁴

Conclusion

Based on a study of the difference in the number of leukocytes of users of water from Martapura River and users of water from PDAM Bandarmasih, it was concluded that the average number of neutrophils and monocytes, lymphocytes and eosinophils of the people using the water from Martapura River in August 2018 were 54.03%, 7.43%, 34.80% and 3.2%. The average numbers of neutrophils, monocytes, lymphocytes and eosinophils of the people using the water from PDAM were 54.9%, 10.1%, 32.8% and 4.39%, respectively. The statistical results showed no significant differences between the average number of neutrophils, monocytes, lymphocytes and eosinophils of the water users of Martapura River and the water users of PDAM Bandannasih.

Source or Funding: Domestic government

Conflict of Interest: There is no conflict of interest in this study.

Ethical Clearance: This study obtained a label of ethics approved by the number: 761/K-EPK-FKUNLAM/EC/VIIU2018 on August 10, 2018

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