Distribution of blood type among dengue hemorrhagic fever patients in Semarang City

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Abstract. Dengue Hemorrhagic Fever is an infectious disease caused by dengue virus which is transmitted through bites of Aedes aegypti or Aedes albopictus[1]. In Indonesia particularly, there has not been much research on ABO blood type associated with dengue fever occurrence [2]. This study aims to see the ABO blood group description and its relation to the incidence of dengue hemorrhagic fever in Semarang. The DHF sample cases were obtained from three hospitals in Semarang city (n=39), from the period of March to May 2017 and the control groups were obtained from healthy respondents with matched age, sex, and the district location (n=39). The data was analyzed by Chi-Square test. The frequency distribution of blood groups in DHF patients was 6 type A (15.4%), 10 type B (25.6%), 7 type AB (17.9%) and 16 type O (41.0%). In control there were 10 type A (25.6%), 12 type B (30.8%), 9 type AB (23.1%) and 8 type O (20.5%). Comparison between blood group B, AB and O to blood group A resulted in the p-value of 0.875, 1.00, and 0.136 which not significant. Although DHF cases at three hospitals in Semarang are not related to blood type, the highest percentage of the patients had O blood group (41%).

Keywords: Dengue Hemorrhagic Fever, Blood Type, Aedes aegypti

1. Introduction

According to the data from WHO, showed that Asia ranked first in the number of DHF patients annually and the countries that have the highest DHF cases were Indonesia, Bangladesh, India, Maldives, Sri Lanka, Thailand and Timor Leste [3]. The number of dengue cases in Indonesia during the last years 2013-2015 showed fluctuations. It is reported from 2013 to 2014, the number of DHF cases was decreased from 112,51 to 110,347, but in the following year of 2015, the number increased with 129,650 cases and 1071 deaths. Three provinces in Indonesia with the highest rates of dengue fever from 2014 to 2015 were still Bali (257.75), East Kalimantan (188.46), and North Kalimantan (112.00) per 100,000 population [3]. The incidence of DHF in Semarang city in the year of 2015 reached 1.737 cases and it was decreased to 448 in 2016. The number of Incidence Rate (IR) in Semarang City in 2015 increased from 92.45 to 98.61 and was ranked third in Central Java after Magelang and Jepara. But in 2016 the number of Incidence Rate has decreased significantly to 25.22. The Prasti research in Semarang found that dengue cases increased at a low temperature (≤27°C) with...
an average number of cases of 220.8 cases and at high humidity levels, > 80% of cases were 218.8. This happened during rainfall between 200 and 400, the cases of DHF increased to 194.4 cases. This proved that the incidence of DHF strongly influenced by the local climate situation [4].

Blood is a long-distance mass transport in the body for various materials between the cell and the external layers or between the cells themselves [5]. The ABO blood group system is a classification of human blood based on the inherited nature of red blood cells (erythrocytes) which was determined by the absence of antigens in the blood surface [1]. The study of the correlation between blood groups and disease was first hypothesized by Kaipainen and Vuorinen in 1960, and the genes involved in the ABO blood group were discovered in 1990. Vitthal Kode’s research in India of 119 dengue sufferers showed that blood type O was the most affected blood type [6]. Another study conducted in Thailand show the same result, from 399 patients with dengue (DD and DHF), there were 160 patients had blood type O [7]. There has not been researching that can directly prove the correlation between blood type O and the incidence of DHF. From the previous background, this study aims to determining the distribution of blood groups of the DHF patients in 3 hospitals in Semarang.

2. Method
The type of this research was observational analytics with case control group design. The data was conducted at one time approachment. In a case-control study, the study begins with the identification of patients with certain effects or diseases (called cases) and a group with no effects known as controls to determine whether a particular risk factor actually affects the disease and comparing the frequency of exposure of the risk factor in the case group with the frequency of exposure in the control group. The case group was a patient of DHF which was hospitalized in three hospitals in Semarang city, RS Dr. Adhyatma, MPH, RSUP dr.Kariadi and RS K.R.M.T Wongsonégoro from March to May 2017. The control group was a neighbor of the DHF patient who has never suffered from DHF and had the same characteristics including age, sex and domicile. Both of the case and control group were 39 respondents.

3. Result
Characteristic of respondents both in case and control groups can be seen in table 1. Show us that DHF mostly occur on people who are productive age, in table 1 we see it in range age 0-14 years old (41%) and 15-49 years old (53.8%).

| Variable  | DHF incidence |   |   |
|-----------|---------------|---|---|
| Age       |               |   |   |
| 0-14 years old | 16 41 | 16 41 |
| 15-49 years old | 21 53,8 | 21 53,8 |
| 50-65 years old | 2 5,1 | 2 5,1 |
| gender    |               |   |   |
| Man       | 21 53,8 | 16 41 |
| Female    | 18 46,2 | 23 59 |
| Education |               |   |   |
| Primary school | 24 61,5 | 21 53,8 |
| Junior high school | 4 10,3 | 8 20,5 |
| Senior high school | 9 23,1 | 9 23,1 |
| College   | 2 5,1 | 1 2,6 |

Table 1. Characteristic of Respondents
The majority of respondents 0-14 years old was 16 (41%) both in case and control group. In this study, the number of male respondents was bigger than female respondents. Most respondents had education of the primary school, which were 24 respondents (61.5%) in the case group and 21 (53.8%) in the control group. Table 2 show the distribution of blood type in DHF patients.

Table 2. Distribution of Blood Type

| Blood type | DHF incidence |          | Case | %  |         | Control | %  |
|------------|---------------|----------|------|----|---------|---------|----|
|            | f    | %    | f    | %  |         |         |    |
| O          | 16   | 41   | 8    | 20.5|         |         |    |
| B          | 10   | 25.6 | 12   | 30.8|         |         |    |
| AB         | 7    | 17.9 | 9    | 23.1|         |         |    |
| A          | 6    | 15.4 | 10   | 25.6|         |         |    |
| Total      | 39   | 100  | 39   | 100 |         |         |    |

The majority of respondent have blood type O, with 16 respondents (41%) in the case group and 8 respondents (20.5%) in the control group. Who had blood type B were 10 respondents (25.6%) in the case group and were 12 respondents (30.8%) in the control group. The blood type AB were 7 respondents (17.9%) in the case group and were 9 respondents (23.1%) in control group. And the blood type A were 6 respondents (15.4%) in the case group and were 10 respondents (25.6%) in control group. In table 3 shows the relationship between blood type and DHF with blood type A as a comparison.

Table 3. Recapitulation of Blood Type Relations with Dengue Hemorrhagic Fever

| Variable | DHF incidence | p-value | OR    | 95%CI           |
|----------|---------------|---------|-------|-----------------|
|          | Case | %  | Control | %  |       |         |       |     |
| O        | 16   | 41 | 8   | 20,5| 0,136 | 3,333  | 0,890-12,489 |
| A        | 6    | 15,4 | 10 | 25,6|       |         |       |     |
| B        | 7    | 53,8  | 9 | 47,4| 0,875 | 1,389  | 0,373-5,172 |
| A        | 6    | 15,4 | 10 | 25,6|       |         |       |     |
| AB       | 10   | 62,5 | 12 | 54,5| 1,000 | 1,296  | 0,315-5,322 |
| A        | 6    | 15,4 | 10 | 25,6|       |         |       |     |

From the statistical test result using chi-square test, the comparison between blood type A and O was showed there was no difference in proportion between blood type O and A (p=0.136) with DHF. In addition, the value of OR 3.333 with confidence interval between 0.890-12.489. The chi-square test on comparison between blood type B and A showed the p-value 0.875; it indicated that there was no difference proportion between blood type B and A with DHF. The value of OR 1.389 with confidence interval between 0.373-5,172. And chi-square test on the comparison between blood type AB and A showed that there was no difference proportion between blood group AB and blood group A (p =1,000) with DHF. With the value of OR = 1.296 with confidence interval 0.315-5.322.

4. DISCUSSION

Female Ae. aegypti is a major vector in the transmission of DHF. The research conducted by Harrington about the habit of female Ae. aegypti in biting humans revealed several things. Female Ae. aegypti preferred human blood than animal blood (cats, cows, pigs, chickens, and mice). This was due to the accumulation of energy obtained when the female Ae. aegypti sucked human blood. It is known before, that in human blood there are various types of amino acids, glucose, triglycerides and others. Some of these contents are studied in favor of mosquitos [8].
Another experiment that was conducted by Harrington was to compare the fondness of female Ae. aegypti between human blood and rat blood. Rats had an amino acid (isoleucine) 3 times more than humans. The duration of this experiment was 10 days and the first initial hypothesis of this experiment was that Ae. aegypti would preferred human blood whose isoleucine level was lower than rats. The female Ae. aegypti could incubate more eggs if the level of isoleucine were not too high. This proved by the final result of the experiment that 52.4% of female Ae. aegypti preferred to bite human or can be said, preferred human blood [8].

Besides the isoleucine levels, the triglyceride content in human blood proved to be an essential element needed by the female Ae. aegypti for its survival. Triglycerides are the main energy source for female Ae. aegypti for resting habits. Female Ae. aegypti can synthesize triglycerides in the human blood and have no habit of flying long distances and will stay indoors, where there are a host, male mosquitoes as a couple, and breeding grounds are always available [8].

Basically, Aedes mosquitoes have an interest in the heat of carbon dioxide that released from the body. Another thing that mosquitoes also like is the smell of human skin. It happens because there a chemical call sulcatone which becomes an important element in the creation of the odor itself which for the mosquitoes themselves, odor indicates the food source [9]. ABO blood type system is a classification of human blood based on the inheritance of red blood cells (erythrocytes) determined by the presence or absence of antigen with a special chemical structure which is a long chain of sugars called fukosa [1] carried on the surface of red blood cells in which people can have blood type A, type B, type O, or type AB [6]. Blood type A, B, and O were first identified by Austrian immunologist Karl Landsteiner in 1901. In this study, the percentage of blood group of whole dengue sufferers was blood type O 24 (30.8%), blood type B 16 (20.5%), blood group AB 22 (28.2%) and blood group A 16 (20.5%). A study in Thailand with a sample of 399 consisted of Dengue Fever patients and DHF patients showed that type blood O was (40.1%), then A (20.5%), B (32.3%) and the last was blood type AB (7.1%) [7]. The same thing was also seen in the result of the research in India with 244 respondents consisted of DHF and non-dengue patients, it showed that the percentage of blood type that more affected by DHF were blood group O (42.8%), B (32.7%), A (21%) and AB (3.3%) [6].

An immune system that consisted of natural killer cells, macrophages, natural antibodies that produce B cells are predisposing factors that determine a person's vulnerability or resistance to viral infections. HLA (Human Leukocyte Antigen) and blood type, are thought to be factors that play an important role in individual's susceptibility to infectious diseases [8]. HLA lies in the short arm of the sixth chromosome in which there are three MHC loci expressed functionally in natural immune response and adaptive to microbes. Includes genes that encode classic I and class II HLA molecules, which serve to present short peptides from microbes to specific antigen-CD8 + and CD4 + T-cell receptors. Class I HLA molecules are also recognized by other receptor groups that determine which cells infected with the virus will experience spontaneous lysis by NK cell activity. Thus the HLA molecule is recognition element that plays an important role in the natural and adaptive immune response to the virus [2]. Dengue virus also affects the regulation of HLA expression in infected cells. So that class I and II HLA molecules play a major role in the immune response to the Dengue virus. Some class I and class II HLA alleles are associated with the occurrence of DHF and play a role in the severity of dengue infection [2].

5. Conclusion
1. The number of male respondents was bigger than female respondents both in case and control group. Most of the research respondents had a final education of the primary school, 24 respondents (61.5%) in the case group and 21 respondents (53.8%) in control the group.
2. The majority of blood type that the respondents had was blood type O, 16 respondents (41%) in the case group and 8 respondents (20.5%) in control the group. The least of the blood type was AB with 10 respondents (25.6%) in the case group and 12 respondents (30.8%) in the control group.
3. There was no significant correlation between blood types with dengue hemorrhagic fever.
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