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## Gene distribution of ABO blood type system on the Dengue Hemorrhagic Fever (DHF) patients in the working area of Puskesmas Bonto Bangun, District of Rilau Ale, Bulukumba

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# Gene distribution of ABO blood type system on the Dengue Hemorrhagic Fever (DHF) patients in the working area of Puskesmas Bonto Bangun, District of Rilau Ale, Bulukumba

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**Abstract.** This research is about gene distribution of ABO blood type system on the Dengue Hemorrhagic Fever (DHF) patients in the working area of Puskesmas Bonto Bangun, District of Rilau Ale, Bulukumba. This research aimed to determine the blood type which is most affected by DHF using ABO blood type system. In this research, there are 104 samples, 8 of them were attacked by DF and 96 were attacked by DHF. From the 96 patients of DHF, there were 38 patients with A-blood type, 17 patients with B-blood type, 36 patients with O-blood type and 5 patients of AB-blood type. The data were tested using genotype frequency test and the results showed that the percentage of A-homozygous blood type ( $I^A I^A$ ) is 0.09%; A heterozygous blood type ( $I^A I^O$ ) is 0.36%; B-homozygous blood type ( $I^B I^B$ ) is 0.01%; B heterozygous blood type ( $I^B I^O$ ) is 0.12%; AB blood type ( $I^A I^B$ ) is 0.06% and O blood type ( $I^O I^O$ ) is 12.36%. So the biggest frequency of genotype are  $I^A I^O$  (0.36%) and  $I^O I^O$  (0.36%). The results showed that O blood type gene is the most affected by DHF. Then continued by the regression test between blood type and DHF, it is obtained that the correlation value is 1 which indicated that there is a strong relationship.

## 1. Introduction

Blood is a liquid tissue consisting of two parts, namely blood plasma and blood cells. Blood cells consist of three types: erythrocytes, leukocytes and platelets. The overall blood volume is one-twelfth of the body weight or about five liters. About 55% are blood plasma, while the remaining 45% consists of blood cells. The main function of blood in the circulatory system is as a medium of transport, regulation of temperature, maintenance of fluid balance, and balance of erythrocyte base during his life remain in the body. The red blood cells are capable of transporting effectively without abandoning its function in the tissues, while its presence in the blood, passes only [1].

According to Land-Steiner in Suryo [2] ABO blood type system can be inherited from to their children. ABO blood type system is divided into four groups namely A, B, AB and O. Blood classification is caused by the type of antigen contained by erythrocytes (red blood cells). The antigens can be carbohydrates, proteins, glycoproteins, or glycolipids and also some of these antigens are in cells of various muscle tissues. Human blood type is hereditary and highly dependent on the blood group of both humans concerned [3].

Dengue Hemorrhagic Fever (DHF) has become an important concern of the health community in the world. Indonesia occupied the highest ranking in ASEAN in the incidence of Dengue Infection. In



2014, until mid-December recorded dengue cases in 34 provinces in Indonesia as many as 71,668 people, and 641 of them died. The number is lower than the previous year, namely in 2013 with the number of people as many as 112,511 people and died as many as 871 patients [4]. Meanwhile data from Disease Control and Environmental Health, Department of Health of South Sulawesi, released data of DHF patients during January 2016 as many as 528 cases. Head of Disease Control and Environmental Health said the data is based on reports from the Regional Public Hospital in 24 districts in South Sulawesi [5]. Meanwhile, data obtained from Puskesmas Bonto Bangun is the number of DHF patients from January to March as many as 142 cases.

Based on the epidemiology paradigm, the outline of a DHF sufferer is influenced by host, agent and environment interaction [6]. Therefore, in addition to the need to deepen the problem of the agent and the handling of environment that support the transmission of dengue is very important also studied more in the role of host (human) in DHF disease. Manifestations of dengue virus infection in humans are varied due to the pathogenesis of dengue disease is very complex. Based on existing research, host factors that may affect the manifestation of dengue infection are ethnicity, heredity, gender, age, nutritional status, secondary infection and immune response [7].

The immune response factor in the host body is different because the immune response is controlled by the natural genes of the human body. Several studies have shown that genes that are suspected to be associated with manifestations of dengue hemorrhagic clinical symptoms include genes that encode the Human Leucocyte Antigen (HLA) molecule, Human Platelet Antigen (HPA), ABO blood group system, IgG receptor cells, Vitamin D receptor and Mannose Binding Lectin.

Based on research conducted Kalayanarooj, et al., [8] one that may be associated with severe dengue virus infection is a factor of blood type. one that may be related to the severity of Dengue virus infection is a factor of blood type. This blood type factor is based on the ABO blood type system, because this blood type system is commonly used. This study suggests that blood type factors play a role in viral elimination. However, due to limited samples there was no significant difference in each blood group. In addition, according to Rahayu, et al., [9] also obtained a description of blood type AB is a risk factor for the occurrence of Dengue Shock Syndrome (DSS) in children with DHF. This phenomenon is thought to be caused by cross-reactions between antigens and antibodies owned by DHF patients.

Another opinion expressed by Hartanto [10] in his research on blood type O relationship with shock occurrence in DHF patients found no significant association between blood type O and shock occurrence in DHF patients but there were differences about clinical manifestations of significant bleeding among blood group O and non blood group O. This can lead to worsening of shock in DHF. Further research conducted by Kurniawan [11] in his research on the relationship of blood type ABO against dengue virus infection, from the study concluded that blood type O has a relationship to dengue virus infection which is the factor of occurrence of DHF. Based on the above background then conducted a study on DHF patients in the work area of Puskesmas Bonto Bangun to know the blood type most affected by DHF based on the ABO blood type system.

In this study, we have analyzed serological parameters of DHF carriage in a group of 104 adults. The 8 participants were confirmed positive for Dengue Fever (DF) and 96 participants were confirmed positive for Dengue Fever (DF) at Puskesmas Bonto Bangun, Carriers were tested for identified blood type and analysed it by gene frequency analysis with Weinberg and regression analysis test.

## **2. Materials and Methods**

Materials used in this study were blood samples of dengue patients, 70% alcohol, serum anti-A type, serum anti-B type, and cotton. For blood sampling, we inserted the lancet into the autoclick and set it at the appropriate depth of the number. Then, apply 70% alcohol on the surface of the respondent's fingers. Next, press the autoclick over the fingers that have been smeared with alcohol. Then press the stabbed hand to get the blood out. The blood is placed on the glass of preparations. Then, drop the serum anti-A and serum anti-B. Observe the changes that occur on the glass that has been dropped blood, serum anti-A and serum anti-B.

The population in this study were all people suspected of having Dengue Hemorrhagic Fever who checked himself into Puskesmas Bonto Bangun. From the preliminary data taken from puskesmas there are about 140 population.

The sample is an affordable part of the population that can be used as a research subject by sampling. Sample size can be calculated by this formula:

$$n = \frac{N}{1 + N(d^2)} \quad (1)$$

n = sample size

N = population size

d = level of significance (e)

Based on that formula, sample that needed in this research are 104 people.

Data analysis was done in 2 ways, ie gene frequency analysis with Weinberg and regression analysis test. Gene frequency analysis was performed using the Hardy-Weinberg equilibrium law. The equations of the Hardy-Weinberg equilibrium law are:

$$p + q + r = 1 \quad (2)$$

p = Person with blood type A

q = People with blood type B

r = People with blood type O

Regression analysis test is used to determine whether there is influence of blood group with DHF. Regression analysis test was done by using SPSS 22 tools.

### 3. Result and discussion

Based on data from research that has been done in the work area of Puskesmas Bonto Bangun, Rilau Ale, Bulukumba District in September to December with the number of samples of 104 people. In this study other than blood type, also researched the sex and the type of infection in the respondent and obtained the following results:

**Table 1.** Data based on the respondent sex.

Sex	Total	Percentage (%)
Male	57	54.8
Female	47	45.2

From the research data, there are 104 respondents, it is known that the number of dengue male respondents is 57 people (54.8%) and female (47.2%).

**Table 2.** Data based on infection type.

Infection Type	Total	Percentage (%)
DF	8	7.7
DHF	96	92.3

Based on the type of dengue infection, the data obtained as many as 8 people (7.7%) of DF and as many as 96 people (92.3%) attacked by DHF.

**Table 3.** Data based on blood type.

Blood Type	Total	Percentage (%)
A	42	40.3
B	18	17.3
AB	5	4.9
O	39	37.5

Based on blood type, it was found that A blood type result were 42 people (40,3%), B blood type were 18 people (17.3%), AB blood type were 5 people (4.9%) and O blood type were 39 people (37.5%).

Based on research conducted, DF patients as many as 8 people. Patients with A blood type as many as 4 people (50%), people with B blood type as many as 1 person (12.5%), people with O blood type as many as 3 people (37.5%) and AB blood type sufferers.

**Table 4.** Patients with DF based on blood type.

Blood Type	Total	Percentage (%)
A	4	50
B	1	12.5
AB	0	0
O	3	37.5

**Table 5.** DHF based on Blood Type.

Blood Type	Total	Percentage (%)
A	38	37.59
B	17	17.70
AB	5	5.20
O	36	37.5

Based on the research conducted on 96 DHF patients, there were 38 people (37,59%) with DHF, DHF patients with B blood type as many as 17 people (17.70%), DHF patients with O blood type as many as 36 people (37.5%), DHF patients with AB blood type as many as 5 people (5.20%).

**Table 6.** Allele Frequency of blood type on DHF patients.

Allele Frequency	Frequency (%)
$I^A$ (p)	0.3
$I^B$ (q)	0.1
$I^O$ (r)	0.6

Based on the research conducted on 96 DHF patients known Frequency allele for  $I^A$  is 0.3, the allele frequency for  $I^B$  is 0.1 and the frequency of allele I for  $I^O$  is 0.6.

From the results of genotypes frequency calculation results obtained for A-homozygous blood type ( $I^A I^A$ ) of 0.09%, A-heterozygous blood type ( $I^A I^O$ ) of 0.36%, B-homozygous blood type ( $I^B I^B$ ) of 0.01%, B-heterozygous blood type ( $I^B I^O$ ) of 0.12%, AB blood type ( $I^A I^O$ ) of 0.06% and O blood type ( $I^O I^O$ ) of 0.36%.

**Table 7.** Genotype frequency of blood type on DHF patients.

Genotype	Frequency (%)
I <sup>A</sup> I <sup>A</sup>	0.09
I <sup>A</sup> I <sup>O</sup>	0.36
I <sup>B</sup> I <sup>B</sup>	0.01
I <sup>B</sup> I <sup>O</sup>	0.12
I <sup>A</sup> I <sup>B</sup>	0.06
I <sup>O</sup> I <sup>O</sup>	0.36

Research on the gene distribution of ABO blood type in patients with DHF in Puskesmas Bonto Banguns, Rilau Ale, Bulukumba District. This study aims to determine the blood type most affected by DHF. From the research that has been done in September - December with the number of samples as many as 104 people were obtained as many as 57 people (54.8%) men and 47 people (45.2%) women. This shows no significant difference between men and women. No susceptibility difference for DHF is associated with sex differences. In the Philippines it was reported that the sex difference was 1:1. Similarly in Thailand there was no reported difference in susceptibility to dengue fever between male and female.

In this study found two kinds of dengue infection caused by *Aedes aegypti* mosquito bites DF and DHF. The number of DF patients in this study were 8 people and the number of DHF patients was 96 people. The main difference between DF and DHF is found in the presence of leakage of blood fluid in the blood vessels, which causes the blood to thicken. The presence of leakage of this blood fluid is indicated by an increased haematocrit value. In this study more specifically discusses the blood type in DHF patients.

After the blood group test on 96 DHF patients, it was found that the data of DHF were 38 people (37,59%), DHF patients with B blood type as many as 17 people (17.70%), DHF patients with O blood type as many as 36 people (37.5%), DHF patients with AB blood type as many as 5 people (5.20%). From these data it can be seen that the percentage of blood type most affected by DHF is blood type A and O. This is in accordance with research that has been done by Hartanto<sup>[4]</sup> namely that blood type O affects dengue virus infection. Further research conducted by Kurniawan<sup>[6]</sup> in his research on the correlation of blood type ABO against dengue virus infection, from the study concluded that blood type O has a relationship to dengue virus infection which is the factor of occurrence of DHF.

In some studies showed that von Willebrand factor (vWf) and factor in each ABO blood type system is very different, especially in O blood type which has lower levels than non O blood type. The von Willebrand factor is a glycoprotein consisting of several oligosaccharides that are supplemented by the ABO blood type system.

The von Willebrand factor is encoded by chromosome 12 and is made by endothelial cells and megakaryocytes. Its presence in the blood is required by the liver to make factor VIII. If there is deficiency or defect vWf, then production factor VIII decreases. The vWf function will stimulate the liver to release factor VIII and platelet function to form clumps and attach to sub endothelial tissue. VWf serves to help attach platelets to sub endothelium. Sub endothelial is the main source of vWf plasma.

Capillary endothelial cells are assumed to play a role in the pathogenesis of DHF and begin to be widely investigated in vitro. This is due to vascular leakage and thrombocytopenia in DHF is pathogenesis and related to the integrity of the impaired capillary endothelium. In essence, haemostatic is a very complex physiological mechanism that will keep the blood in the circulation. A very diverse path can initiate the formation to prevent those following a trauma. When the tissue is injured, the blood vessels will be disturbed and bleeding will occur through wounds in the blood vessels.

From the data of each blood group in DHF patients then the frequency of allele is calculated. Based on the results of research that has been done allele frequency for  $I^A$  is 0.3, allele frequency for  $I^B$  is 0.1 and allele frequency  $I$  for  $I^O$  is 0.6. After the allele frequency is known then the next calculation for each genotype frequency. Gene frequency is the frequency of the presence of a gene in a population in relation to the frequency of all alleles.

Based on the data from the research, the results obtained for A-homozygous blood type ( $I^A I^A$ ) of 0.09%, A-heterozygous blood type ( $I^A I^O$ ) of 0.36%, B-homozygous blood type ( $I^B I^B$ ) of 0.01%, B-heterozygotes blood type ( $I^B I^O$ ) of 0.12%, AB blood type ( $I^A I^B$ ) of 0.06 and O blood type ( $I^O I^O$ ) of 0.36%. Based on the calculation of genotype frequency it can be seen that A-heterozygous blood type ( $I^A I^O$ ) has the same frequency with O blood type ( $I^O I^O$ ). It shows that most people with DHF are O blood type because A heterozygous blood type still have recessive O blood type gene.

After done Test Regression analysis got result of correlation value of blood type with DHF equal to 1. This suggests that the relationship between blood type and DHF is very strong. After testing, the Anova table of probability value (F-count) obtained by 0.000 < 0.05 thus the regression equation model based on the research data is significant, meaning that the linear regression model meets the linearity criteria, and in the table coefficient obtained the probability value t-count 0.000 < 0.05 indicates rejected and  $H_1$  accepted.

#### 4. Conclusion

Genotype of O and A blood type O which is the blood type most affected by DHF.

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