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Analysis of voluntary blood donors' characteristics during the third-peak of COVID-19 in Bojonegoro regency, Indonesia

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ABSTRACT

The third peak of the Coronavirus Disease 2019 (COVID-19) in Indonesia which was recorded on February-March 2022 had an impact on voluntary blood donations at the Indonesian Red Cross (IRCS) Bojonegoro. The objective of this research was to analyze the voluntary blood donors' characteristics during the third COVID-19 peak in Bojonegoro Regency. This descriptive, analytical study was conducted using secondary blood donor data from February 22, 2022 to March 19, 2022 at IRCS Bojonegoro. The data were collected in the blood donor selection process in accordance with the Indonesian and World Health Organization (WHO) blood donor selection guidelines. The average number of voluntary blood donors per day was tested using the Mann-Whitney-U test with a significance of $p<0.05$. The results showed 219 people (80.51%) between 22-28 February and 332 people (83.63%) between 1-19 March 2022 who were approved to donate at IRCS Bojonegoro. There was a significant decrease in the average of male voluntary blood donors per day ($p=0.01$), average age group: 17-24 years ($p=0.013$), 35-44 years ($p=0.002$), and 45-54 years ($p=0.030$), hemoglobin (Hbl) levels on 16.1-17.0 g/dL ($p=0.000$), systolic blood pressure (SBP) <120 ($p=0.03$) and 130-139 ($p= 0.02$) and diastolic blood pressure (DBP) <80 ($p=0.001$), pulse rate (PR) 65-74 beats/minute ($p=0.016$), and blood type O+ ($p=0.008$). The characteristics of voluntary blood donors during the third peak of COVID-19 in Bojonegoro Regency indicated there was a significantly decreased number of male voluntary blood donors per day around ages 17-24 and 35-54 years, with Hbl between 16.1-17.0 g/dL, SBP <120 and 130-139 mmHg, DBP <80 mmHg, PR 65-74 beats/minute, body weight 45-54 and 65-74 kg, and blood type O+.

Keywords: Blood donor selection process; characteristic; Indonesian Red Cross Society; third-peak of COVID-19; voluntary blood donor.

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INTRODUCTION

The Coronavirus Disease 2019 or COVID-19, is an infectious disease caused by Severe Acute Respiratory Syndrome Corona Virus 2 (SARS-CoV2) that was first reported in Wuhan, China, in late 2019. This disease has affected almost everyone worldwide and has been reported in more than 213 countries.[1] The incubation period for COVID-19 is known to be 14 days from first exposure to the symptomatic onset. Symptoms of COVID-19 include SARS, fever, cough, shortness of breath, anosmia/hyposmia, dysgeusia, and in more severe cases, pneumonia, kidney and liver failure, and even death. The transmission of this virus occurs through droplets, both sneezing and coughing and also contaminated air, especially in closed spaces. The virulence and mutations of COVID-19 cause the disease to be more easily transmitted from one person to another.[2]

On March 11, 2020, the World Health Organization (WHO) finally assessed that COVID-19 can be characterized as a pandemic such as SARS-CoV and the Middle East Respiratory Syndrome Corona Virus (MERS-CoV) that cause life-threatening disease.[3] This virus has several variants that have caused waves or sudden increases of infected patients in many countries. On January, 2022, the WHO updated that there was a new variant of COVID-19, Omicron (B.1.1.529). As the incidence also increased in Indonesia, the third peak was recorded at February-March, 2022 with more than 130,000 cases per 1 million of the population and was classified as community transmission 3 (CT3) for all provinces (national data).[4] The cases at the third peak were relatively higher than the second peak (Delta variant) at July-August, 2021 with incidence of COVID-19 reaching 110,000 cases per 1 million population and also classified as CT3 for national data. Based on Sigal's research, the case fatality ratio of the omicron variant was two times lower than the delta variant.[5] This is due to the behavior of people who were more careful than at the beginning of the pandemic, such as getting vaccinations, regularly washing hand, social or physical

distancing, self-isolation and quarantine of those who have contracted or potentially contracted COVID-19.[6] Moreover, the interactions with other people were limited and changed to an online version for meeting and shopping behaviors.[7]

The Indonesian Red Cross Society (IRCS) is the center of blood donation activities in Indonesia, including in Bojonegoro Regency. There is no evidence of transmission of this virus through transfusions of blood and its components. Several studies also explained that the transfusion of blood and its components from donors diagnosed with COVID-19 after donation does not cause disease in blood recipients.[8] All blood donations at IRCS centers involve donors selected through a national and standard health history from the blood donor selection process and also done considering doctor's anamnesis.[9] This blood donor selection process has a role to ensure both donor and recipient safety. This process consists of screening at the registration and health check. All blood from donations including voluntary blood donation will be screening by laboratory testing for several transfusion transmitted infections (TTIs) such as human immunodeficiency virus (HIV), hepatitis-B/C, and syphilis.[9] However, the pandemic situation has limited community activities and has impacted on blood donation activities at IRCS Bojonegoro. Furthermore, there has been no research on the effect of the COVID-19 outbreak, especially during the third peak, on the number of voluntary blood donors in Bojonegoro Regency. Therefore, this research aimed to analyze the voluntary blood donors' characteristics during the third-peak COVID-19 in Bojonegoro Regency.

METHODS

Research design

A descriptive analysis study was conducted at the Indonesian Red Cross Society (IRCS) Bojonegoro, East Java, Indonesia during February 22, 2022 and March 19, 2022 at IRCS Bojonegoro. The inclusion criteria were voluntary blood donors who pass all the criteria (approved) at the blood donor selection process. The exclusion criteria were voluntary blood donors who did not pass all criteria (rejected) during the selection process. All voluntary blood donors received donor informed consent according to Indonesian blood donor selection guidelines (form 3.2).[9] Informed consent is accepted if the donor signed the form.

Blood donor selection process

The blood donor selection process is a stage to determine the prospective blood donors according to Indonesia blood donor selection guidelines and WHO, including the age of the donor must be in the range around 17-65 years, a minimum weight of 45 kg, hemoglobin level (Hbl) around 12.1-17.0, systolic blood pressure (SBP) around 100-160 mmHg and diastolic blood pressure (DBP) around 70-100 mmHg, body temperature around 36.6-37.5 °C, pulse rate (PR) around 50-100 beats/minute, and determination of blood type following ABO and Rh systems.[9]

Data collection

This study was conducted on secondary blood donor data collected in the blood donor selection process between February and March, 2022 including total registration of voluntary blood donation, demographic characteristics (age and sex), early screening (weight, Hbl, SBP, DBP, PR, and blood type) and donor status (approved or rejected).

Statistical analysis

The average number of voluntary blood donors per day was tested using the Mann-Whitney-U test which is a non-parametric statistical analysis method using SPSS 23 software (IBM Corp., Armonk, NY). The non-parametric analysis was used in this study because the data to be used were not normally distributed. *P*-value equal or less than 0.05 was regarded as significant.

RESULTS

Table 1 shows the data of 669 voluntary blood donors who presented to Indonesian Red Cross Society (IRCS) Bojonegoro around February and March, 2022. During February 22-28 there was a total registration 272 voluntary blood donors consisting of 219 (80.51%) who were approved to donate blood and 53 (19.49%) were rejected due to several reasons such as low Hbl and BP. During March 1-19, 2022, the voluntary blood donors consisted of 332 (83.63%) who were approved to donate blood and 65 (16.37%) were rejected. There was a percent change of total blood donation during study. Total blood donation increased 3.86% around late February to early March 2022 while for total rejection decreased 16%.

The characteristics of voluntary blood donors from February 22 until March 19, 2022 are described in Table 2, which shows that the average of voluntary blood donors per day decreased for each characteristic, except for the Hbl which increased by 33% in the range of 15.1-16.0 g/dL although the change was not significant ($p>0.05$). The average of the male voluntary blood donors in February compared to March 2022 significantly decreased ($p=0.01$), while the average of female voluntary blood donors did not significantly decrease ($p>0.05$). The average age of voluntary blood donors (approved) was significantly decreased for 17-24 years old ($p=0.013$), 35-44 years old ($p=0.002$), and 45-54 years old ($p=0.030$).

Table 2 reveals that almost all ranges of Hbl did not significant decrease ($p>0.05$), except for the hemoglobin range of 16.1-17.0 g/dL down until 92.31% (p=0.000). For BP, there was a significant decrease in systolic <120 ($p=0.03$) and 130-139 ($p=0.02$) and diastolic <80 ($p=0.001$). Meanwhile, the PR significantly decreased for range 65-74 beats/minute ($p=0.016$).

Table 1. Total voluntary blood donors at Indonesian Red Cross Society (IRCS) Bojonegoro around February and March, 2022.

No	Variable	February 2022 (%)	March 2022 (%)	Percent change (%)
1	Total Registration	272	397	
2	Total Donation (approved)	219 (80.51)	332 (83.63)	+3.86
3	Total rejection	53 (19.49)	65 (16.37)	-16.0

Note: Data source: February 22-28, 2022 and March 1-19, 2022.

The range of BW of blood donors (45-54 kg and 65-74 kg) significantly decreased (p=0.016). Furthermore, there was a significant decrease for blood type only for O+ (p=0.008).

DISCUSSION

The COVID-19 pandemic has caused severe limitations for people's interactions and activities. This condition has also affected the blood donation activity at the Indonesian Red Cross Society (IRCS) Bojonegoro. The results of this study showed that in Bojonegoro regency during the third peak of the outbreak COVID-19 (February-March, 2022), the

Table 2. Characteristics of voluntary blood donors who were approved during third-peak COVID-19 in Bojonegoro regency.

No	Characteristics	February 2022 (x̄)	March 2022 (x̄)	Changed rate (%)	Mann-Whitney-U test analysis February to March 2022 (p-value)
1	*Sex*:				
	Male	30	14	-53.33	0.010*
	Female	6	5	-16.67	0.658
2	*Age (years old)*				
	17-24	9	5	-44.44	0.013*
	25-34	7	5	-28.57	0.562
	35-44	11	4	-63.64	0.002*
	45-54	8	4	-50.00	0.030*
	≥55	2	1	-50.00	0.865
3	*Hemoglobin level (HbL)(g/dL)*				
	12.1-13.0	9	5	-44.44	0.101
	13.1-14.0	5	5	0.00	0.201
	14.1-15.0	4	4	0.00	0.973
	15.1-16.0	3	4	33.33	0.227
	16.1-17.0	13	1	-92.31	0.000*
4	*Blood pressure (BP) (mmHg)*				
	Systole blood pressure (SBP)				
	<120	6	3	-50.00	0.030*
	120-129	12	7	-41.67	0.155
	130-139	12	5	-58.33	0.020*
	≥140	5	4	-20.00	0.562
	Diastole blood pressure (DBP)				
	<80	25	12	-52.00	0.001*
	80-89	8	6	-25.00	0.354
	≥90	3	1	-66.67	0.155
5	*Pulse rate (PR) (beats/minute)*				
	55-64	1	1	0.00	0.759
	65-74	8	4	-50.00	0.016*
	75-84	16	8	-50.00	0.062
	85-94	9	5	-44.44	0.052
	≥95	4	3	-25.00	0.919
6	*Body weight (kg)*				
	45-54	4	1	-75.00	0.016*
	55-64	10	6	-40.00	0.286
	65-74	13	6	-53.85	0.016*
	75-84	7	6	-14.29	0.227
	≥85	2	1	-50.00	0.117
7	*Blood type*				
	A+	4	2	-50.00	0.155
	B+	3	2	-33.33	0.919
	AB+	1	1	0.00	0.658
	O+	18	14	-22.22	0.008*

Note: Data source: February 22-28, 2022 and March 1-19, 2022
(x̄) = daily average number
* = p<0.05 (*significant*).

percentage of voluntary blood donors who were approved through the blood donor selection process changed by +3.86% (Table 1). The positive results happened because at the beginning of March, the community activities had begun to increase following the trend of COVID-19 cases which had begun to decline compared to February.[10] It was also supported by the new normal regulatory policy of the Indonesian government such as large-scale social restriction, social distancing, wearing masks everywhere especially for indoor activity, etc.[11] Moreover, the blood donations at blood centers were reduced due to the COVID-19 outbreak worldwide[12] especially at the third-peak around January-March.[10]

This study revealed the daily average voluntary blood donors declined both for males and females, but it was significantly decreased only for males (p=0.010) (Table 2). This might be due to the higher mobility of males that increased following the new normal regulatory policy of the Indonesian government such as working at the office. This makes males have a higher chance to donate blood than females. Moreover, the International Labor Organization (ILO) stated that males in Indonesia have more opportunity and a greater legal limit to work, which is influenced by community cultural standards in regard to the masculine labor opportunities.[13]

Blood donation awareness might be a part of the knowledge obtained from a person's educational background and their social community, especially information sharing among young age-group. Moreover, social identity theory suggests that group membership is a source of identity that is used as a guide for member activities, including the donor community.[14] This study showed that at the ages around 17 until 24 years old voluntary blood donors significantly decreased (p=0.013) at the third peak COVID-19 in Bojonegoro (February-March, 2022). This decrease might be due to online education and limited activities at school or college for students.[15] This result was not in line with the research conducted by Rafiee *et al.* in 2021 that reported a higher number of donations in the age-group of 18– 24 years during the outbreak in Iran.[16] Furthermore, at the age ranges 35-44 and 45-54 years old there were also significantly decrease, p=0.002 and p=0.03 respectively. This condition occurs because when COVID-19 cases increase, as a result, many agencies in Bojonegoro implement work from home (WFH), then the community activities also declined. WFH is a policy to allow employees be more flexible to carry out their work activities as home-based tasks.[17] Moreover, this research is partly in line with the research of Gkirtsou *et al.* in 2022 indicating blood donations during the COVID-19 pandemic in the Thrace Region, Greece were dominated by the age of 27-49 years.[18]

Hemoglobin (Hb) is a protein contained in red blood cells (erythrocytes) that is responsible for delivery of oxygen through the body and all tissues. Hemoglobin level must be maintained to ensure the adequate tissue oxygenation.[19] In this study showed that the Hb of voluntary blood donors was significantly decrease at range of 16.1-17.0 g/dL (p=0.000). It could be due to the voluntary blood donors were was mostly male. The normal Hb level for males is 13.5-17.5 g/dL and for females is 12.0-16.0 g/dL.[20] However, the number of male voluntary blood donors during February 22 until March 19, 2022 decreased. This also affects the number of people whose Hb levels are checked in the blood donor selection process. Furthermore, the recent studies showed that there was no evidence that COVID-19 infection could influence the Hb level.[19]

Blood pressure (BP) and pulse are important requirements that must be met by voluntary blood donors. BP is the pressure of blood through blood vessels and circulate throughout the body. This pressure is needed to make blood flow, provide nutrients and oxygen along the body. The BP readings are divided into systolic blood pressure (SBP) and diastolic blood pressure (DBP). Normal SBP is less than 120 mmHg and normal DBP is less than 80 mmHg.[21] Pulse rate (PR) is a blood waves caused by contraction of the left ventricle in the heart. The normal adult PR lies between 60 to 90 beats per minute (bpm).[22] In this study, the number of voluntary blood donors who have had their SBP (<120 mmHg; p=0.03 and 130-139 mmHg; p=0.02) and DBP (<80 mmHg; p=0.001) checked was significantly decrease. Meanwhile, PR of voluntary blood donors was also significantly decreased at range 65-74 beats/minute (p=0.016). This shows that the BP and pulse were also influenced by the number of people who pass the donor selection.

According to this research, there were two groups of body weight of voluntary blood donors which showed significantly decrease (p=0.016), i.e., with the weight around 45-54 and 65-74 kg, during the time of COVID-19 third peak in March 1-19, 2022 and February 22-28, 2022, respectively. This significant decrease in the number of voluntary blood donors during the third-peak in Bojonegoro regency was influenced by the number of blood donors who participated and passed the donor selection process. However, there is no maximum weight limit for donating blood among blood donors according to the national guidelines.[9]

Blood type is a system of grouping blood based on the type of antigen on the surface of erythrocytes. Blood type using ABO system is determined by the presence or absence of A or B antigens expressed by red blood cells and the presence or absence of A or B antibodies in serum or plasma. Based on the ABO blood type system, there are 4 blood groups, namely blood groups A, B, AB, and O.[23] The dominant blood type in this research which was significantly decreased only for O+ (p=0.008). The number of donors influenced the decline of O+ blood type. Type O blood is known to have more frequency than other blood types, which is 42% of the world's population.[24] Veseli *et al.* in 2022 stated that in Germany during the COVID-19 pandemic there was a significant decline in voluntary blood donors' activities.[25] However, the negative effect of intention to donate blood is less influential for active blood donors who donate regularly. The intention of some people to donate blood is based on personal feelings and concern for humanity.[8] Blood donation could be one vital activity to save lives and provide alternate opportunities for more personal donations than other donations such as monetary donations and social volunteer activities.[24] Furthermore, some people also

realize that blood donation activities can be a form of self-efficacy because it can show that they are in good health.[26]

CONCLUSIONS

The characteristics of voluntary blood donors during the third peak of COVID-19 in Bojonegoro Regency decreased significantly in the number of male voluntary blood donors per day around ages 17-24 and 35-54 years, Hb between 16.1-17.0 g/dL, SBP <120 and 130-139 mmHg, DBP <80 mmHg, PR 65-74 beats/minute, body weight 45-54 and 65-74 kg, and blood type O+. For further research, demographic and geographic differences may be observed which may be useful for ongoing public health surveillance under the influence of mutation-induced COVID-19 variations.

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CONFLICT OF INTERESTS

The authors declared no conflict of interest.

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AUTHOR CONTRIBUTION

SN contributed in concepts, design, defenition of intellectual content, literature serach, data analysis, statistical analysis, manuscript preparation, manuscript editing, manuscript review, and guarantir. CCD, EJQ, DAK, and ESA contributed in design, literature search, data acquisition, manuscript preparation.

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