

## Blood cholesterol and its related factors among Indonesian blood donors

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### ABSTRACT

Blood donation nowadays were considered to improve health status of the donors by declining human's cholesterol level. The high level of cholesterol inside the blood bags influenced the blood quality. However, there was limited data about cholesterol level and its influencing factor on the blood donors. This cross-sectional study aimed to analyse the associated factors of cholesterol levels in blood donors. This study involved 120 respondents using the purposive sampling as sampling method. Data was collected using questionnaires and blood cholesterol examination. The obtained data was analysed using univariate and bivariate statistic tests with significance level  $\alpha=0.05$ . This study found that the majority of respondents aged 35-45 years (60.8%) and male (60.8%). More than half respondents were routine to donate their blood. Although they consumed cholesterol foods, their cholesterol level remained normal (88.3%). This study also found that blood donation had an association with cholesterol level  $p=0.000$ , while the other variables did not show any relationship. The normal cholesterol level among blood donors was influenced by frequent blood donation. Further study needs to be explored about the activities and the foods type to identify the cholesterol level among blood donors.

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## 1. INTRODUCTION

Hyperlipidemia was being a major factor in leading non-communicable disease in the world, which caused global mortality [1]. Nowadays, people experienced hyperlipidemia from the young age [2]. The high level of lipid, especially cholesterol, would increase along with the aging process [3]. Various hyperlipidemia managements were offered, for instance statins administration. However, this treatment often resulted poor outcome since patients were not adhere to the statin treatment, showed intolerance or resistance of statin [4]. Previous study revealed that hyperlipidemic status was corelated with frequency of blood donation [5], [6]. However, there was insufficient research and data about the cholesterol level and its influencing factors among blood donors in the world, especially in Indonesia.

Blood donation is known as the act of donating blood voluntarily to the others. Individual aged 18-65 years old could be a donor with total blood amount up to 450 ml in each donation [7]. As a benefit, blood donation could reduce the excess of iron concentration in the human body. Some blood donors showed iron depletion while frequently donating their blood [8]. Besides, donating blood regularly also decreased the ferritin concentration [9], [10]. Regular blood donation within six months resulted lower levels of high-sensitivity CRP (hs-CRP), endothelial function improvement, also decreasing diastolic blood pressure [11]. These effects could put blood donation as a therapy to obtain the optimum cholesterol level, compared to the

other methods [12]. The alternative methods were revealed, for example consuming valproic acid, curcumin consumption, and cupping therapy [13]–[15]. On the other hand, a recent study explained that frequent blood donation had a correlation with an unfavourable fluctuation of lipid serum level, but it showed weakly contribution to increase the risk of coronary heart disease [16].

During blood donation process, all the donors needed to receive procedures explanation then signed an informed consent [17]. The donors had to understand about the donation procedures and its associated side effects, such as iron deficiency; their medical condition, including transfusion-transmissible infection; and the information of donation purposes [17]. Despite iron deficiency presented negative consequences, for instance, cognitive and physical performance impairment, fatigue, and anaemia; it could escalate the cholesterol oxidation and reduce the reactive oxygen species (ROS) formulation [18]–[20]. In addition, the excess of lipid particles in blood bags provoked the transfusion units could not be used since its poor quality [20]. It would increase process-costs in order to examine the quality of blood-transfusion if there were numerous high-lipid transfusion units [21].

Blood cholesterol levels were influenced by various factors, including gender, age, diet, activity, and the consumption of cholesterol medicines [22]. Nowadays, various ages have been experiencing the high level of blood cholesterol due to unhealthy lifestyle and consuming fatty food. Hypercholesterolemia affected the young adults who seemed to be healthy [23]. A high amount of total cholesterol was commonly associated with hypertension, also put an individual into a risk of coronary heart disease [24], [25]. Another study mentioned that a history of heart disease in a family influenced the hyper-lipidemic level among donors [5]. Based on those explanations, this study was aimed to analyse the factors related to the cholesterol levels in blood donors.

## 2. RESEARCH METHOD

This study used a correlation design with a cross-sectional approach to analyse related factors of cholesterol levels in blood donors. All the research procedures were conducted from February until March 2019. Before the study was organized, this research's ethical clearance has been approved by the research ethics commission of STIKES Karya Husada Kediri No. 134/KH/I/2019. This research involved 120 respondents that have been chosen using purposive sampling method. The inclusion criteria of the research sample were blood donors in a Centre of Red Cross, East Java, Indonesia who signed informed consent.

This study used two kinds of instruments for data collection. Factors associated with blood donation cholesterol were measured by 10-items questionnaire using open questions. Besides, the cholesterol blood levels were measured using a portable cholesterol test device, which would measure the total fat in the blood. This device only needed a little amount of blood and showed less negative effect. The accuracy rate of this device is about 95% or close to the results of laboratory measurements.

The obtained data was analysed using univariate and bivariate test with significant level  $\alpha=0.05$ . Moreover, the data analysis in this research used Spearman's rank correlation. The statistical result showed that there was an abnormal distribution of the variables and the scale level was ordinal.

## 3. RESULTS AND DISCUSSION

This study found that the blood cholesterol level among donors were in the normal category (88.3%). It was followed by the frequency of blood donation, which mentioned that the most of respondents were routine to donate their blood. Furthermore, lifestyle factors such as the absence of smoking behaviour and avoiding cholesterol foods consumption indicated that respondents had good lifestyles. Almost hundred research subjects admitted that they have never smoking (80%) and consuming cholesterol-contained foods (80%). Based on demographic data, this study subjects were dominated by senior high school graduates rather than bachelor degree Table 1. Besides, the majority of respondents were in the productive age around 35-45 years old (60.8%). However, the respondent's gender did not represent the same percentage, which only about one-third respondents were female.

This study revealed that cholesterol level among blood donors was significantly associated with the frequency of blood donation. Previous study stated that hyperlipidemic condition had positive association with single-time blood donation [5]. Recently, statin had been administered as coronary arterial disease related-to the high lipid concentration- treatment in the last three decades, however this treatment considered to be ineffective for patients with high lipoprotein [26]. People with high level of low-density lipoprotein (LDL) were commonly administered some lifestyle modification in the six months, if they did not have any risk factors [27]. Moreover, people with LDL level more than 190 mg/dL should receive a combination of lipid lowering therapy and lifestyle modification [27]. The American college of cardiology revealed several new non-statin medications, for example bempedoic acid and inclisiran, which considered to have great low-

density lipoprotein (LDL) lowering efficacy [28]. Furthermore, this study result provided an offer to reduce cholesterol level using blood donation method.

Table 1. Characteristics of respondents (n=120)

Characteristic	n	%
Age		
35-45	73	60.8
45-55	34	28.3
>55	13	10.8
Gender		
Male	73	60.8
Female	47	39.2
Educational background		
Senior high school	73	60.8
Bachelor degree	47	39.2
Frequency of blood donation		
Not routine	20	16.7
Routine	54	45
Very routine	46	38.3
Frequency of consuming foods containing cholesterol		
Sometimes	52	43.3
Often	68	56.7
Never	0	0
Smoking behaviour		
Never	96	80
Sometimes	10	8.3
Often	14	11.7
Level of cholesterol		
Normal	106	88.3
High limit	8	6.7
High	6	5

All dependent variables showed different relationship with respondent's cholesterol level. According to p value, the frequency of blood donation was presenting strong relationship with the cholesterol level  $p=0.000$ . Nevertheless, the other dependent variables did not prove any significant relationship with cholesterol level. Cholesterol foods consumptions had p-value about  $p=0.351$ , while smoking behaviour showed  $p=0.659$ . These lifestyle factors did not present any correlation to the level of respondent's cholesterol, as same as with the demographic factors Table 2.

Table 2. Relationship between age, gender, educational background, consuming cholesterol foods frequency, and smoking behaviour with cholesterol levels

Relationship between variables	n	p
Age with level of cholesterol	120	0.403
Gender with level of cholesterol	120	0.353
Education background with level of cholesterol	120	0.382
Frequency of blood donation with level of cholesterol	120	0.000
Frequency of consuming foods containing cholesterol with level of cholesterol	120	0.351
Smoking behaviour with level of cholesterol	120	0.659

Another study explained that the experience of blood donors would increase the probability of returning blood and built up the high intention to donate again, hence would make the cholesterol of donors decrease to the normal level [29]. The cholesterol level among respondents remained in the normal category. This result was in line with the frequency of blood donation, which showed that majority respondents donated their blood. Blood donation initiated iron depletion, which would intrigue a more healthy cardiovascular profile [18]. Donating blood periodically would decline the levels of cholesterol, plasma low-density lipoprotein (LDL), and triglycerides; hence lowering the risk development of cardiovascular disease [30]. Multiple time blood donation could decrease the risk of coronary heart disease by diminishing blood viscosity and excessive iron [16]. Therefore, the subjects of this research demonstrate optimum level of blood cholesterol since their habits in donating blood. On the other hand, cholesterol levels in blood donors did not present any relationship with the other factors such as age, gender, educational background, consumption of foods containing cholesterol, and smoking behavior.

Almost whole respondents claimed that they had not have smoking behavior whereas their cholesterol level appeared to be normal. On the other hand, a study revealed that smoking showed high risk of dyslipidemia although it had no significant association [31]. Smokers likely confirmed higher risk of elevated low-density lipoprotein and total cholesterol, also declining high-density lipoprotein cholesterol [32], [33]. Smoking generated an elevating of catecholamine, cortisol, lipolysis, and the level of triglyceride [34], [35]. The nicotine of cigarettes induced fat degradation, which could injure beta-cells in the pancreas [36]. Besides smoking behavior, dietary habits appeared a relationship with cholesterol level [37]. Despite all the respondents consuming cholesterol-contained foods, their cholesterol level remained normal. Less than one-third respondents showed high level of cholesterol. This result was similar with a study that stated there was no significant association between cholesterol dietary intake and low-density lipoprotein level [38]. While, previous study revealed that consuming cholesterol foods no more than once a week would acquire higher potential controlled low-density lipoprotein, instead of consumed four times a week [39]. People who had regular eating schedule, ate high-protein foods three times a day, and consumed dairy products, demonstrated significant controlled triglyceride and total cholesterol [39], [40]. Eating vegetable less than 91.5 grams a day built up the risk of hs-CRP level [41].

Gender, educational background, and age also did not demonstrate any significant relationship to the cholesterol level. More than half respondents were aged between 35-45 years old. Previous research found that people aged 30-39 years and older showed 3-4 times more to have high cholesterol levels compared to the youngers aged [42]. People would potentially experience metabolic syndrome along with the aging process [43]. Besides, people who suffering dyslipidemia were likely in the older ages and men gendered [44]. A study mentioned that hypercholesterolemia was more common in men instead of women [45]. On the other hand, women had lower triglyceride level but higher high-density lipoprotein than men [46]. Women were likely having 1.4 times higher risk of cholesterol level compared to men group [42]. Women tend to have high body fat than men although men presented high prevalence in general obesity [46]. This general obesity related to dyslipidemia was common experienced by married men aged 41-50 years and having low educational background [46]. In addition, metabolic syndrome could decrease by the increased education level [43]. The good knowledge about hypercholesterolemia demonstrated a better attitude towards cardiovascular disease prevention related to the hypercholesterolemia [47].

Unfortunately, our result did not provide the cholesterol amount periodically, hence there were no report about how much cholesterol intake per individual. Moreover, our study did not explore the medication history and physical activity among respondents, which could be a compensation in reducing cholesterol level. Physical exercise is proven to be effective and safe for reducing the risk of cholesterol diseases [48]. In addition, supplement consumption was diminishing the risk of mortality because of heart failure related to the dyslipidemia [49].

However, the study had some inherent limitations. This study is better supported by qualitative and quantitative studies. Further studies need to assess the other factors influencing cholesterol level towards blood donors, such as body weight, history of cholesterol diseases, and physical exercise [48], [50].

#### 4. CONCLUSION

This study revealed a significant relationship between frequency of blood donation and the cholesterol level among blood donors. The multiple blood donation induced the reducing blood viscosity by lowering the total cholesterol, low-density lipoprotein (LDL) plasma, and triglyceride. Although the other variables did not show any relationship with cholesterol level, blood donation could be as an alternative way to lower cholesterol level in regards to prevent cardiovascular disease.

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