Morphological Identification of Erythrocytes in Adolescent Males Who Consume Coffee

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Abstract. Coffee contains a lot of substances which, if consumed in excess, will have a bad effect on health, caffeine is no exception. Caffeine can affect the absorption of iron in the body. The purpose of this study was to determine the characteristics of the respondents and the morphology of the erythrocytes. This type of research is descriptive qualitative. The sampling technique was carried out by Simple Ran-dom Sampling of 35 respondents who met the inclusion criteria. The primary data collection technique was carried out by filling out questionnaires by respondents. Then, blood sampling was carried out using micro-sampling techniques on capil-lary blood, and peripheral blood smears were made. Finally, the peripheral blood smear was stained using wright paint. The identification of erythrocyte morphol-ogy in coffee-consuming male adolescents residing in the working area of the Sumobito Health Center in the age range of 18-21 years with the highest frequen-cy at the age of 21 (37.14%). All respondents consumed 2 to 3 cups of coffee a day. The frequency of drinking coffee for more than five years was 71.45%. The type of coffee consumed was black coffee 77.15%. The results showed that 60% of the respondents had erythrocyte morphology abnormalities or abnormal color, shape, and size indicators. It is expected that teenagers who consume coffee will reduce their consumption because coffee contains caffeine. Caffeine in the body may affect the absorption of iron in the body. Lacking iron for the processing of forming red blood cells can lead to iron deficiency anemia.

Keywords: Coffee, Boys, Erythrocyte Morphology

1 BACKGROUND

According to a study conducted by Briawan, D., Rara, T., and Ekayanti, I. in 2011, it was found that the fluid intake from syrup-type beverages among adolescent boys (94ml) was higher compared to girls (73ml) ($p>0.05$). Among these syrup-type beverages, it was observed that teenage boys preferred coffee intake significantly more than girls, who tended to opt for other types of syrup beverages.

Based on observations and questionnaires created and distributed randomly by re-searchers in the city of Jombang over a span of 5 days, filled out by 100 respondents with a distribution of 34% female and 66% male participants in the teenage age range of 10-24 years old and unmarried, the following results were obtained: 87% (87 individuals) consume coffee, and 13% (13 individuals) do not consume coffee. The chosen duration of coffee consumption by the respondents shows that 64% (64 indi-viduals) have been consuming coffee for less than 5 years, while 36% (36 individu-als) have been consuming it for more than 5 years. As for the frequency of coffee consumption per day, 94% of the respondents choose to consume coffee 2-3 times a day, while 6% choose to consume it 4-5 times a day.

Basically, coffee contains a multitude of beneficial substances if not consumed ex-cessively, one of which is caffeine. According to Indonesian National Standard (SNI) 01-7152-2006, the maximum threshold for caffeine content in food or beverages is 150mg/day or 50mg/serving. If coffee consumption

exceeds the specified threshold, the body may encounter difficulties in the absorption of iron. This difficulty in iron absorption leads to a decrease in hemoglobin and hematocrit levels in the blood (Wick et al, 2012).

Citing research conducted by Lauseva, R, in 2019, out of 33 individuals examined, 24 individuals exhibited low hemoglobin levels with an average value of 13.3 g/dL, compared to the normal range of 13.5-17.5 g/dL. Additionally, in a study conducted by Maduratna, D.A.A in 2022, out of 30 individuals examined, 18 individuals dis-played abnormal hematocrit levels with an average value of 39.9%, whereas the normal range for adult males is 42-52%.

According to Kiswari, R. in 2014, routine hematological examinations such as meas-uring hemoglobin and hematocrit levels can serve as a simple initial screening to de-termine anemia in patients' bodies. The hematocrit value can be used in calculating the red blood cell indices, meaning that the lower the hematocrit value, the fewer red blood cells are present in the body (Schumacher et al, 2000). A decrease in hemoglobin levels below the normal range indicates that the oxygen level in the blood is low and has an impact on health, including anemia (Samsudin, R.R., Maulidiyanti, E.T.S., Purwaningsih, N.V., 2020). Abnormalities in erythrocyte morphology are influenced by pathological conditions, such as in individuals with anemia (barger, Anne M, 2022).

Hence, it is necessary to conduct a hematological examination by performing a pe-ripheral blood smear test (Gulati et al, 2013). The purpose of conducting a peripheral blood smear exam-ination is to ascertain the elements of blood cells such as erythrocyte morphology, thrombocytes, leukocytes, as well as identifying any present parasites (Ardina and Rosalinda, 2018). As a result, this examination can reveal abnormalities in erythro-cyte morphology.

2 RESEARCH METHODS

This research is a qualitative descriptive study aimed to determine the characteristics of respondents, conduct examinations, and identify the morphology of abnormal erythrocytes in adolescent males. The research population consists of 1430 adoles-cent males who are coffee consumers in the Sumobito Primary Health Care Working Area. The sample for this study includes adolescent males aged 18-24 years, residing in the Segodorejo and Sumobito villages, consuming black coffee 2-3 cups per day, having a coffee consumption frequency of more than 2 years, and willing to partici-pate in the research. The sample size obtained is 35 adolescents.

Blood sampling was conducted in the villages of Segodorejo and Sumobito. The ex-aminations were carried out at the Clinical Pathology Laboratory of the D3 Medical Laboratory Technology Program, Muhammadiyah University of Surabaya. This research was conducted from May 25th to July 9th, 2023.

The tools and materials used in this study are lancet, alcohol swab, autoklik, glass slide, Wright's stain, distilled water, oil immersion, and distilled water. This research began with obtaining informed consent from prospective participants. Subsequently, capillary blood sampling was conducted, followed by the preparation of peripheral blood smears, which were stained with Wright's stain and observed under a micro-scope at a magnification of 100x using oil immersion.

3 RESULTS AND DISCUSSION

Based on the research results obtained from the examination of the morphology of erythrocyte adolescent males in the working area of Sumobito Community Health Center, there were 35 respondents who met the inclusion criteria, as follows:

Table 1. Distribution of Respondent Characteristics Based on Education in Sumobito Community Health Center Work Areas in May 2023

Education	Frequency	(%)
High School	6	17,14
Higher Education	12	34,29
After high school or start working.	17	48,57
Total	35	100

Table 2. Distribution of Respondents' Characteristics Based on Age in the Working Area of Sumobito Community Health Center in May 2023

Age	Frequency	(%)
18 years old	6	17,14
19 years old	1	2,86
20 years old	7	20
21 years old	13	37,14
22 years old	2	5,71
23 years old	2	5,71
24 years old	4	11,44
Total	35	100

Table 3. Distribution of Respondent Characteristics Based on Types of Coffee Consumed in the Working Area of Sumobito Public Health Center for the Month of May 2023.

Types of coffee	Frequency	(%)
Black Coffee	27	77,15
White Coffee	7	20
Cappuccino	1	2,85
Total	35	100

Table 4. Distribution of Respondent Characteristics Based on Types of Coffee Consumed in the Work Area of Sumobito Community Health Center in May 2023

Jenis Kopi	Frequency	(%)
Kopi Hitam	27	77,15
White Coffee	7	20
Cappuccino	1	2,85
Total	35	100

Table 5. Distribution of Respondent Characteristics Based on Daily Coffee Frequency in the Operational Area of Pusk-esmas Sumobito for the Month of May 2023

Frekuensi Harian	Frequency	(%)
2-3x	35	100

4-5x	0	0
Total	35	100

Table 6. Distribution of Respondents' Characteristics Based on Coffee Consumption Duration in the Working Area of Sumobito Community Health Center in May 2023

Consumption Duration	Frequency	(%)
>5 years	25	71,43
<5 years	10	28,57
Total	35	100

Table 1 shows that all respondents who consume coffee are males in the age range of 18-24 years, with the highest percentage at the age of 21, namely 37.14%, residing in the working area of Sumobito Community Health Center. The culture of consuming coffee is familiar among the community, including teenagers residing in the Sumobito Community Health Center area (Czarniecka et al, 2021). Consuming coffee is considered a part of "masculinity" or "manliness," as explained by Diananda, A (2019), that the age of 18-24 years is an advanced teenage phase characterized by the desire to be the center of attention and stand out. Therefore, teenage boys are more inclined to consume coffee to meet the expectations and stereotypes that prevail in society (Lone A et al, 2023).

Apart from the culture and stereotypes prevalent in society, other factors also influ-ence the preference for coffee consumption among male teenagers compared to female teenagers. According to the researcher's observations, 37.14% of respondents who are 21 years old mostly choose not to continue their education at the university level due to the economic conditions of the community, which encourages these teenagers to fulfill the needs of their families. With the majority of the population working as farmers, farm laborers, and entrepreneurs, they are considered unable to meet their families' living expenses.

Based on physiological effects, according to the researcher's observations, male teenagers who have consumed coffee tend to be more energetic in their activities compared to females. Especially at the age of 18-24, teenagers tend to be idealistic, have high aspirations, enthusiasm, and abundant energy (Diananda, A, 2019). These physiological effects can be one of the factors influencing the increasing interest of male teenagers in coffee. As stated by Wachjidono and Yahya (2021), males are more active at night, and consuming coffee can help them stay awake in the morning.

In addition to the familiar cultural practice of coffee consumption and physiological effects, taste preference is also one of the factors influencing the high interest of male teenagers in consuming coffee compared to female teenagers (Nu, C. T., MacLeod, P., &Barthelemy, J., 1996). Based on the re-searcher's observations and supported by the research results in Table 3, it is evident that 77.15% of teenagers prefer consuming black coffee over white coffee or cappuccino. Certain types of coffee have stronger or bitter tastes, and this strong and bitter taste is generally found in black coffee more than other types (Drewnowski, A, 20021). In fact, this is preferred by a portion of male teenagers more than female teenagers.

Table 4 indicates that all male teenagers who were subjects of the study consume coffee 2-3 times a day. In the researcher's observation, this amount of coffee con-sumption is done by teenagers in the morning, afternoon, and evening when they gather with peers or colleagues to relax, do tasks, or work.

Furthermore, Table 5 shows that 71.43% of respondents who have been consuming coffee for more than 5 years are influenced by several factors. According to the re-searcher's observation, these factors include habit, social effects, heightened alertness effects, and interconnected physical and mental dependence.

The habit of consuming coffee is the most influential factor among teenagers who have been consuming coffee for more than 5 years. Starting from drinking coffee during middle school or pre-adolescent phase, this habit continues into the advanced teenage phase. In terms of heightened alertness effects and physical dependence, most teenagers complain that not consuming coffee daily can lead to impacts like a lack of enthusiasm in their activities (Owens, J et al, 2014). Meanwhile, during the advanced teenage phase, teenagers are striving to secure their future lives. Mental dependence occurs because caffeine is an addictive substance that can cause addiction. Therefore, teenagers who have been consuming coffee for more than 5 years tend to develop dependence and consume 2 to 3 cups of coffee every day.

The results from Table 6 indicate that a total of 60% of the respondents in the study exhibited abnormal erythrocyte morphology or variations, encompassing three indi-cators: changes in color, shape, and size. The observed alterations included Stomato-cytes, Elliptocytes/Ovalocytes, Tear Drops, Helmets, Burr cells, Macrocytes, and Hypochromic cells.

These changes can be attributed to the presence of substances in coffee that hinder the absorption of iron in the body, with caffeine being the main culprit (Aguilera Garrido, AM, 2023). Caffeine can rapidly disrupt and impact the iron absorption process in the body, preventing iron from being absorbed and leading to its excretion through feces (Jane and Balz, 2006). Insufficient iron in the body results in the utilization of existing iron reserves; once these reserves are depleted, the production of red blood cells diminishes, subsequently reducing the levels of hemoglobin in the body (Handelman, G.J and Levin, N.W, 2008). This is because the synthesis of hemoglobin relies on the availability of iron and adequate nutritional intake within the body (Bakta, 2013).

Persistent iron deficiency leads to the depletion of iron reserves, reducing the supply of iron for erythropoiesis (red blood cell formation) and causing disturbances in erythrocyte shape (Gelaw, Y., Woldu, B and Melku, M, 2019). Consequently, hypochromic microcytic anemia, commonly known as iron-deficiency anemia, may occur. This is characterized by altered erythrocyte appearances in peripheral blood smears, including microcytic size, ovalocyte/elliptocyte shape, and hypochromic coloration (Greer, J et al, 2013).

However, the research findings demonstrate that the predominant changes are in the form of stomatocytes and ovalocytes/elliptocytes. This aligns with previous studies and clinical conditions associated with individuals suffering from iron-deficiency anemia. This is further supported by a study conducted by Lauseva et al. in 2019, which showed that out of 33 individuals, around 75% exhibited decreased hemoglo-bin levels, averaging 13.3 g/dL. The normal range according to Regional Health Laboratorty, as cited in Ana (2018), is 13.5 to 17.5 g/dL. Another study by Yulianti et al. in 2021 found that out of 33 individuals, 20 exhibited lowered hemoglobin levels with an average of 13.2 g/dL, compared to the normal range of 14-17 g/dL from the hematological practical module (2019). The observed changes weren't highly significant, indicating that other factors, such as alcohol consumption and others, might contribute to the alterations in erythrocytes.

Based on the researcher's observations, respondents not only consumed coffee but also consumed alcohol. Alcohol consumption can indeed lead to changes in erythro-cyte morphology, specifically stomatocytes. However, the alcohol consumption among respondents was infrequent, as evidenced by the relatively sparse occurrence of altered erythrocyte morphology within the same slide, although it was dominant across all samples. Therefore, the prevailing outcome across all samples was the pres-ence of stomatocytes.

4 CONCLUSION AND RECOMMENDATION

First, Respondent characteristics can influence changes in erythrocyte mor-phology. Second, Out of 21 respondents, a percentage of 60% experienced changes in erythrocyte morphology, including size, shape, and color. Meanwhile, the remaining 40% did not undergo any alterations in erythrocyte morphology.

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