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Distribution of ABO and RhD Blood Groups among Students of Universitas Kader Bangsa Palembang

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ABSTRAK

Data distribusi golongan darah ABO dan RhD pada mahasiswa di Palembang masih terbatas, padahal data ini berguna sebagai informasi awal pemetaan calon donor di lingkungan kampus. Penelitian ini bertujuan menggambarkan distribusi golongan darah ABO dan RhD pada mahasiswa Universitas Kader Bangsa Palembang. Penelitian deskriptif potong lintang ini dilakukan di Laboratorium Imunoserologi Universitas Kader Bangsa Palembang pada 10 Januari 2025 terhadap 200 mahasiswa yang dipilih secara acak sederhana. Golongan ABO ditetapkan dengan metode tabung melalui *forward grouping* dan *reverse grouping* menggunakan plasma, sedangkan status RhD ditetapkan dengan anti-D. Data disajikan sebagai proporsi dengan interval kepercayaan (IK) 95%, disertai analisis eksploratif dengan uji *chi-square*. Golongan O paling banyak (37,0%; IK 95% 30,3–44,1), diikuti B (28,0%), A (26,0%), dan AB (9,0%). Sebanyak 199 mahasiswa (99,5%) RhD positif dan satu mahasiswa (0,5%; IK 95% 0,01–2,75) RhD negatif. Hasil *forward* dan *reverse grouping* sesuai pada 200/200 sampel. Tidak ditemukan perbedaan bermakna distribusi ABO menurut jenis kelamin (p = 0,980) maupun penyimpangan bermakna terhadap proporsi donor Yogyakarta (p = 0,850). Pada sampel ini, urutan golongan darah adalah O > B > A > AB dengan RhD negatif yang jarang. Data ini dapat menjadi informasi awal untuk edukasi dan perencanaan donor darah sukarela di kampus..

Keywords: donor darah; golongan darah ABO; mahasiswa; metode tabung; RhD

ABSTRACT

Data on the distribution of ABO and RhD blood groups among university students in Palembang are limited, although such data are useful for preliminary mapping of potential donors on campus. This study aimed to describe the distribution of ABO and RhD blood groups among students of Universitas Kader Bangsa Palembang. This descriptive cross-sectional study was conducted at the Immunoserology Laboratory of Universitas Kader Bangsa Palembang on 10 January 2025 among 200 students selected by simple random sampling. ABO groups were determined by the tube method using forward grouping and reverse grouping with plasma, and RhD status was determined with anti-D. Data were presented as proportions with 95% confidence intervals (CI), with exploratory chi-square analyses. Group O was the most common (37.0%; 95% CI 30.3–44.1), followed by B (28.0%), A (26.0%), and AB (9.0%). A total of 199 students (99.5%) were RhD positive and one student (0.5%; 95% CI 0.01–2.75) was RhD negative. Forward and reverse grouping results were concordant in 200/200 samples. No statistically significant difference in ABO distribution by sex was detected (p = 0.980), nor a significant deviation from the proportions reported for Yogyakarta blood donors (p = 0.850). In this sample, the blood group order was O > B > A > AB, with RhD-negative status being rare. These data may serve as preliminary information for education and planning of voluntary blood donation on campus.

Keywords : *blood donor; ABO blood type; student; test tube method; RhD*

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Introduction

The ABO and Rh blood group systems are the two most clinically important systems in blood transfusion. ABO blood group is determined by the presence or absence of carbohydrate antigens A and B on the erythrocyte membrane, accompanied by natural antibodies (anti-A and/or anti-B) against the missing antigens, so that determination requires antigen testing (*forward antigen testing). grouping*) and antibody testing (*reverse grouping*) [1,2]. The Rh system consists of many antigens, but the D antigen encoded by *the RHD gene* is the most immunogenic; therefore, Rh positive or negative status in routine transfusion practice essentially refers to the presence or absence of the D antigen (RhD) [3]. ABO incompatibility can cause acute hemolytic transfusion reactions, while exposure to the D antigen in RhD- negative individuals can trigger alloimmunization and hemolytic disease in the fetus and newborn [2,3].

The availability of safe blood depends on voluntary donors who donate regularly. A global report from the World Health Organization (WHO) indicates that access to blood remains unequal, and many low- and middle-income countries face challenges in donor recruitment [4]. College students are a young age group easily reached through campus activities and are therefore often targeted for voluntary donor recruitment [4,5]. However, not all students know their blood type correctly; a study of 1,145 new health students in Saudi Arabia found that approximately one-quarter of students did not report their ABO and Rh types accurately when compared with laboratory results [5].

Blood type distribution varies across populations. A large-scale study of 245,307 donors at the Yogyakarta Blood Donor Unit from 2018–2023 reported a sequence of O (38.5%) > B (29.4%) > A (24.1%) > AB (8.0%) with a RhD negative proportion of 0.5% [6]. These data represent donor data from a single region with donor selection criteria, not a survey representative of the entire Indonesian population. A different pattern was reported in the Asir region of Saudi Arabia, with the sequence O > A > B > AB [7]. In South Sumatra, a study of 187 students from the Palembang Ministry of Health Polytechnic of Health from the local indigenous tribe found that all respondents were Rh -positive, with nearly equal proportions of O and A types [8].

RhD blood types among students at Kader Bangsa University, Palembang. This data is needed as baseline information for the campus and local blood transfusion unit to plan blood donation education and activities, although eligibility and willingness to donate still require separate assessments. The examination in this study was conducted using the tube method, which includes *forward* and *reverse transfection. grouping* because both stages confirm each other and are required for ABO group determination [2,9]. The main objective of this study was to describe the distribution of ABO and RhD blood groups in students at Kader Bangsa University, Palembang. As an exploratory analysis, ABO distribution was also compared by gender and the proportion of donors in Yogyakarta.

Method

Design, location, and time. This study is a quantitative descriptive study with a cross - *sectional design*. Blood sampling and blood typing were conducted at the Immunoserology Laboratory of the Diploma IV Medical Laboratory Technology Study Program, Kader Bangsa University, Palembang, on January 10, 2025.

Population and sample. The research population was active students of Kader Bangsa University, Palembang. The minimum sample size was calculated using the proportion estimation formula $n = Z^2 p (1 – p)/d^2$ [10], with Z = 1.96 (95% confidence level), p = 0.385 (proportion of type O in Yogyakarta donors [6]), and absolute precision d = 0.07, thus obtaining $n = 1.96^2 \times 0.385 \times 0.615 / 0.07^2 = 185.6$ and rounded to 186. The sample size was set at 200 people to anticipate participants or specimens that did not meet the requirements. Participants were selected using a *simple technique Random sampling* from the list of active students. Inclusion criteria were active students aged ≥ 18 years who were willing to

sign *an informed consent form. Consent*. The exclusion criteria for participants was a history of blood transfusion in the last three months, because circulating donor erythrocytes can cause mixed reactions. *field*, and are pregnant, because alloantibodies that can form during pregnancy have the potential to interfere with the interpretation of *reverse transcriptase. grouping* [2]. Specimens that were lysed or frozen were not examined.

Specimen collection and processing. 3 mL of venous blood was aseptically collected into a K3 EDTA tube labeled with the participant's identification code and then examined within 2 hours of collection. The specimen was centrifuged to separate plasma and erythrocytes. Plasma was used for *reverse transcriptase analysis. grouping*, while erythrocytes are made into a 5% suspension for *forward grouping* and RhD determination.

Blood group examination. ABO group was determined using the tube method. On *forward grouping*, one drop of 5% erythrocyte suspension is reacted with one drop of antisera monoclonal anti-A and anti-B. On *reverse grouping* using plasma, two drops of plasma are reacted with one drop of test cell A and 5% test cell B. RhD status is determined by reacting one drop of 5% erythrocyte suspension with one drop of antisera monoclonal anti-D. The tube is centrifuged at 3,400 rpm for 15 seconds, then read macroscopically; the presence of agglutination is declared positive and the absence of agglutination is declared negative [2]. The ABO group is reported if *the forward* and *reverse results are negative. appropriate grouping*. Samples with negative anti-D results are further examined with a *weak D test* using the indirect antiglobulin technique and are declared RhD negative if the test is also negative [2].

Data analysis. Data were analyzed descriptively in the form of frequencies, percentages, and 95% confidence intervals (CI) using the Clopper -Pearson exact method. As an exploratory analysis, the relationship between ABO group and gender was tested using the *chi-square test.* Pearson independence after ensuring all expected frequencies ≥ 5. The suitability of the sample ABO distribution with the proportion of Yogyakarta donors was tested using the *chi-square test. goodness of fit* using the proportions reported in the source (O 38.5%; B 29.4%; A 24.1%; AB 8.0%) [6]. These proportions were treated as fixed references because they were derived from very large registry data. Goodness-of-fit tests were only performed for the ABO category. The significance limit was set at $p < 0.05$.

Research ethics. This study received ethical approval from the Health Research Ethics Committee prior to data collection. Each participant signed *an informed consent form. Consent was obtained* after receiving an explanation. Participation was voluntary and not related to academic assessment. Participant data was recorded using a code and was accessible only to the research team. Test results were communicated privately to each participant and were for informational purposes only and did not replace the blood typing required by transfusion services.

Results and Discussion

A total of 200 university students had their blood types tested, and all data were included in the analysis. The majority of respondents were female (71.0%) and aged 20–21 years (46.0%) (Table 1).

Table 1. Respondent characteristics (n = 200)

Characteristics	n	%
Gender		
Woman	142	71.0
Man	58	29.0
Age (years)		
18–19	64	32.0
20–21	92	46.0
22–23	36	18.0
≥ 24	8	4.0

Source: primary data, 2025.

Blood type O was the most common blood type (37.0%), followed by B (28.0%), A (26.0%), and AB (9.0%) (Table 2). A total of 199 students (99.5%) were RhD positive. One student (0.5%) was blood type O with a negative anti-D result, and their *weak D* test result was also negative, thus being RhD negative . The most common phenotype was O RhD positive (36.5%). *Forward* and

reverse results *grouping* according to 200/200 samples (100%), so that no ABO group discrepancy was found.

Table 2. Distribution of ABO and RhD blood groups (n = 200)

ABO	RhD + n (%)	RhD – n (%)	Total n (%)	IK 95% (%)
O	73 (36.5)	1 (0.5)	74 (37.0)	30.3–44.1
B	56 (28.0)	0 (0.0)	56 (28.0)	21.9–34.8
A	52 (26.0)	0 (0.0)	52 (26.0)	20.1–32.7
AB	18 (9.0)	0 (0.0)	18 (9.0)	5.4–13.9
Total	**199 (99.5)**	**1 (0.5)**	**200 (100.0)**	

Clopper –Pearson exact 95% CI for the total proportion of each ABO group; 95% CI for RhD positive 97.2–99.99% and RhD negative 0.01–2.75%.

The blood group order in this sample (O > B > A > AB) is similar to the pattern reported in Yogyakarta donors [6], and the *goodness of fit test The test of fit* did not find any significant deviation from the comparison proportions ($\chi 2 = 0.80$; df = 3; p = 0.850) (Figure 1). These results cannot be interpreted as evidence that the two populations are equivalent or that the sample is representative of the Indonesian population. The donor population is a selected group that meets donor criteria with an age and gender structure that may differ from university students, while the sample in this study came from a single university. Furthermore, with 200 participants, this test has limited sensitivity to detect small differences in proportions.

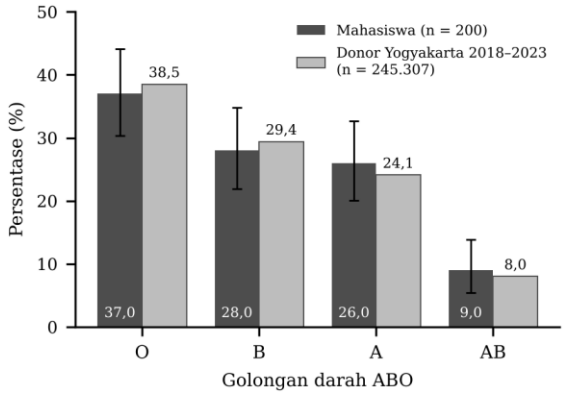

Figure 1. Distribution of ABO blood types in Yogyakarta student and donor samples

The error bar shows the 95% CI of the proportion in the student sample. Yogyakarta donor data for the 2018–2023 period is sourced from Bidayah et al. et al. [6].

The proportion of group O in this study was higher than that of indigenous South Sumatran students, who reported almost the same proportion of groups O (31.0%) and A (30.5%) [8]. Report on community service activities at STIKes Rajekwesi Bojonegoro found the highest blood type B, but the activity only involved 16 students who were selected purposively because they did not know their blood type and were examined using the *slide method* [11]. These results are not intended to describe prevalence and therefore cannot be compared directly with random samples. Differences between studies may be related to sample size and selection methods, ethnic composition, and examination methods; however, this study did not record the ethnicity of participants and did not compare examination methods in pairs, so the cause of these differences cannot be determined.

O group dominance has also been reported in various other populations, although the order of subsequent groups varies. In the Asir region of Saudi Arabia, A group is more common than B [7], and in medical students in the Eastern Province of Saudi Arabia the order is O (51.1%) > A (24.5%) > B (20.4%) [5]. In the literature, this variation is generally attributed to differences in *ABO allele frequencies.* interpopulation [1,6]. This study only examined phenotypes and therefore could not assess allele frequencies or the population origins of the participants.

Forward and *reverse* compatibility *Grouping* across all samples revealed no samples requiring ABO discrepancy testing. This finding is reasonable in a group of young adults who have not received transfusions, as ABO discrepancy in healthy donors is rare; a study of East Indian donors reported a prevalence of 0.12% [9]. The two assays complement each other in ABO determination, not as independent tests for sensitivity or specificity [2,9]. This agreement also does not validate RhD determination, which is determined separately with anti-D.

The proportion of RhD negative individuals in this study (1/200; 0.5%) has a wide 95% CI (0.01–2.75%) because it is based on only one case. The similarity with the Yogyakarta donor (0.5%) [6] is a point estimate, not evidence of a similar population frequency. The low frequency of RhD

negative individuals is consistent with reports in other Asian populations, such as approximately 0.24–0.50% in Han Chinese [12], and with the finding that all respondents were Rh-positive in local studies [8,11]. In East Asian populations, some individuals who appear RhD negative serologically have a DEL phenotype that can only be detected by adsorption-elution techniques or *RHD genotyping [12]; these tests were not performed in this study. The availability of* RhD negative blood stocks was not measured, but the literature suggests that providing RhD negative blood is a challenge in populations with low RhD negative frequencies [12]. Therefore, voluntary registration of RhD negative individuals with the consent of the participants and in collaboration with transfusion services can be considered as a practical implication.

In this sample, no significant association was found between ABO group and sex ($\chi 2 = 0.18$; df = 3; p = 0.980) (Table 3). This finding is consistent with autosomal inheritance of *the ABO* and *RHD* genes [1,3], but a large p-value does not prove equality of distribution; this analysis is also limited by the relatively small number of male participants (n = 58).

Table 3. Distribution of ABO blood types by gender

Group	Female n (%)	Male n (%)	Total n (%)
O	53 (37.3)	21 (36.2)	74 (37.0)
B	40 (28.2)	16 (27.6)	56 (28.0)
A	37 (26.1)	15 (25.9)	52 (26.0)
AB	12 (8.5)	6 (10.3)	18 (9.0)
Total	**142 (100.0)**	**58 (100.0)**	**200 (100.0)**

Source: primary data, 2025. Percentages are calculated based on the number of participants per gender; the total percentage of women is 100.1% due to rounding. *Chi-square test* Pearson independence : $\chi 2 = 0.18$; df = 3; p = 0.980; smallest expected frequency 5.22.

In practice, this data provides a preliminary picture of student blood type composition, which campuses and blood transfusion units can use to plan blood donation education and activities. However, this study did not assess donor eligibility (e.g., hemoglobin levels and medical history), donor interest, or blood stock adequacy, so this distribution data cannot be used to estimate the actual number of donors available.

This study has several limitations. First, the sample was from a single university, and its composition (71.0% female) was not compared with that of all active students, so the results cannot be generalized to the student population or the broader population. Second, the ethnic background of the participants was not recorded. Third, the number of RhD- negative cases was too small to estimate its frequency precisely. Fourth, the external comparator was from a single regional donor population with different characteristics. Fifth, the testing was serological only without molecular confirmation, so specific D variants such as DEL could not be identified. Sixth, data on donor eligibility and willingness were not collected.

Conclusion

In the 200 students studied at Kader Bangsa University, Palembang, the ABO blood type distribution was O (37.0%), B (28.0%), A (26.0%), and AB (9.0%), with 99.5% RhD positive and 0.5% RhD negative. This blood type distribution is similar to the pattern reported in Yogyakarta donors, and no significant differences in ABO distribution by sex were found in this sample.

Universities can collaborate with blood transfusion units to organize education and routine blood donation activities and to register potential voluntary donors, including RhD- negative individuals, with participant consent, contact updates with participant consent, and restricted data access. This blood type data does not determine donor eligibility, which must still be assessed by the transfusion service. Future research is recommended involving multiple universities, capturing ethnic background, assessing donor interest and eligibility, and determining sample size based on the desired precision for RhD- negative individuals; for example, estimating a proportion of approximately 0.5% with a precision of ±0.25 percentage points would require approximately 3,060 participants.

Thank-you note

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Conflict of Interest

The author declares no conflict of interest in this research.

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