# **RESEARCH NOTE**

**BMC Research Notes** 



ABO/rhesus D blood systems and health indices: a preliminary study to find an association among healthy dwellers of Anuradhapura, Sri Lanka

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## Abstract

**Objective** Finding an association between blood groups and diseases would help prevention, early identification, and treatment of diseases. The preliminary study aimed to find an association between ABO/rhesus D blood systems and health indices among healthy dwellers of the Nuwaragampalatha East Medical Officer of Health area of Anuradhapura, Sri Lanka.

**Results** A total of 100 participants were recruited. The blood group in Driving License (67%), Pregnancy Record (17%), Blood Donation Card (11%), Laboratory Report (03%), Old Boy Identity Card (01%), and Service Identity Card (01%) matched the laboratory blood grouping in all participants. The O blood group had significantly fewer hours of sleep per day (P=0.03) and significantly narrower pulse pressure (P=0.02) than the non-O blood group. Also, the O + blood group had significantly fewer hours of sleep per day than the A + blood group (P<0.01). Evidence in the literature is scarce to support these findings. Future large-scale studies among healthy and patient populations are necessary for confirmation.

Keywords Blood group, Hours of sleep, Pulse pressure

## Introduction

Globally, ABO and Rhesus (Rh) blood groups are the most commonly used human blood grouping system and the most important in transfusion and transplantation [1]. ABO classification has 04 groups (O, A, B, AB) depending on the presence or absence of A and B antigens in the red cells [2, 3]. The Rh system confers Rhpositive and Rh-negative status [1]. The human ABO/

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Rh blood systems are associated with different disease entities like circulatory diseases, cognitive disorders, infectious diseases, and malignancy [4]. Hence, the determination of blood groups has clinical importance in assessing health risks.

Cardiovascular disease is the top cause of mortality in the world [5]. Overweight, high blood pressure, glucose, and lipids are known risk factors for cardiovascular disease. Sri Lankan studies showed 1.4% [6] and 1.9% [7] to have > 30% 10-year risk of a fatal or non-fatal major cardiovascular event among patients with type 2 diabetes mellitus respectively. Globally, 1 in every 8 individuals lives with a mental disorder [8]. Around one in every five Sri Lankan population is detected to have depression [9].

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These factors could be optimised via prevention, early identification, treatment and counselling to minimise mortality [5]. Hence, an association of ABO/Rh blood systems with health indices would help prevention, early identification, and treatment of diseases. Studies on an association for ABO/Rh blood systems with cardiovascular and mental health indices are seldom assessed in Sri Lanka. Anuradhapura district is the largest by surface area in the country but, its population density (131 per km<sup>2</sup>) [10] is much lower than the country's density (351 per km<sup>2</sup>) [11]. It is a rural, agricultural district in Sri Lanka. Nuwaragampalatha East (NPE) Medical Officer of Health (MOH) is the division with the largest population and population density in Anuradhapura district [10], has both urban and rural regions in almost equal proportions [12], and includes both the old and new cities of Anuradhapura. Hence, the preliminary study aimed to find an association between ABO/Rh D blood systems and health indices among healthy dwellers of the NPE MOH area of Anuradhapura, Sri Lanka.

## Main text

## Methods

А community-based, cross-sectional, preliminary study with laboratory analysis was conducted during August and September 2024. 100 healthy individuals were recruited as follows in line with the Annual Statistics Report of the National Blood Transfusion Services for the year 2021 [13]: O + = 42, A + = 22, B + = 28participants, O-, A-, B-, AB+, AB- = 08 participants. A male-to-female ratio of 1:1 was maintained. Participants aged  $\geq$  41 to  $\leq$  60 years, Sinhala Buddhist, permanently residing in NPE, MOH area of Anuradhapura district for  $\geq$ 3 years, having an estimated glomerular filtration rate  $(eGFR) \ge 60 \text{ ml/min}/1.73 \text{m}^2 \text{ according to Chronic Kidney}$ Disease Epidemiology Collaboration (CKD-EPI) equation were included. Previous Sri Lankan literature has shown a difference in the prevalence of hypertension [14] and diabetes [15] among different ethnicities. Therefore, a selection criterion "Sinhala Buddhist" was included to have homogenous groups concerning ethnicity to minimize confounding on measurements like blood pressure and fasting blood sugar levels. Individuals with the following were excluded: acute illness, on medications, history of chronic diseases (organic or psychiatric), history of long-term drug treatment, history of immunosuppression (steroid treatment or chemotherapy), other blood group types (E.g. Bombay O), pregnancy, betel chewing, everyday smoking [16], and heavy alcohol use [17]. Considering the stringent nature of the selection criteria, a community-based convenience sampling was done to recruit suitable participants. Objective and selection criteria were informed to dwellers of NPE, MOH area of Anuradhapura district. Participants willing to participate were contacted via phone by the investigator to check eligibility before inviting them to the assigned blood collection centre.

The questionnaire had two separate parts: sociodemographic factors and Depression Anxiety Stress Scale-21 (DASS-21) [18]. The questionnaire on sociodemographic factors was interviewer-administered by the investigator while the DASS-21 [18] available in the Sinhala language [19] was self-administered by the participants with instructions from the investigator. The face validity of the questionnaire on socio-demographic factors was established and subsequently, it was pre-tested in 03 volunteers from the Nuwaragampalatha Central MOH area and necessary modifications were made to improve its language and sequence. The Cronbach's alpha of questions representing depression, anxiety, and stress of DASS-21 was derived. Anthropometric measurements of weight, height, waist circumference, hip circumference, and demi-span (half the distance between the hands outstretched to either side) were measured using a standard digital bathroom scale (SECA robusta 813 CE), stadiometer (SECA 213 CE 0123) and measuring tape respectively. Two blood pressure measurements within a minute interval were measured using a standard aneroid desk model sphygmomanometer (ACCOSON CE 0413) after a 5-minute rest in the seated position. The average of the two measurements was used. Also, pulse rate was measured.

Prior permission was obtained from the Regional Director of Health Services, Anuradhapura. Further, the NPE MOH was informed of the study by the Regional Director of Health Services. Recruited participants, were invited to the assigned blood collection centre (Durdans Hospital laboratory, Anuradhapura) for data and sample collection. Study description, obtaining written informed consent, data collection and anthropometric measurement were done by the study investigator. All necessary measures were taken to preserve the participant's privacy and confidentiality. The blood collection (by trained phlebotomists) and blood analysis (by trained medical laboratory technicians) were done at the Durdans Hospital laboratory, Anuradhapura [20]. It is a Joint Commission International-accredited hospital in Sri Lanka. Procedures for measurement of the above investigations were well established and routinely done at the above laboratory. The process lasted for about 30 min. Participants were requested to report their blood ABO/Rh D blood type in the first instance (e.g. driving license, pregnancy record, blood donation card etc.). A blood sample of 5 ml was obtained for ABO/Rh D blood systems, HbA1c, total cholesterol and serum creatinine from the antecubital vein and transferred immediately to an EDTA (2.5 ml) and a plain tube (2.5 ml). The forward (cell) and reverse (plasma) were done to confirm the true ABO type and Rh D type for each participant. The method used for the analysis of HbA1c is high-performance liquid chromatography. Quality control for HbA1c was done using Bio-Rad Lyphochek low and high control. The method used to analyse total cholesterol and serum creatinine was enzymatic colorimetric assay. Quality control for total cholesterol and serum creatinine was done using Bio-Rad Lyphochek assay chemistry control and Gernorm and Gerpath Quality control respectively. Collected data were entered into a Microsoft Excel spreadsheet (Additional file 1). The data was analysed using Microsoft Excel and online statistics calculators [21]. Mean with standard deviation was reported for continuous variables and frequency with percentages for categorical variables. Also, the World Health Organization/ International Society of Hypertension (WHO/ISH) risk prediction chart for Southeastern Asian Region B was used to predict the 10-year risk of a fatal or non-fatal cardiovascular event [22]. Mann Whitney U test (O blood group vs. non-O blood group) and Kruskal-Wallis test with post hoc Dunn's test (O + vs. A + vs. B + vs. Other) were performed (p < 0.05).

## Results

Most of the study participants were head of household (52%), completed the general certificate of education (advanced level; the highest level of examination sat within the Sri Lankan high-school education system) or above (78%), employed full-time (76%), currently married (97%), not living alone at the household (99%), urban residents (100%), and having a monthly household income of more than 100,000 Sri Lankan rupees (83%). Also, most had  $\leq 1$  adult male in the household (60%),  $\geq 2$  adult females in the household (58%), no male children in the household (78%), and no female children in the household (62%). Further, most never consumed alcohol (80%), never smoked (98%), and never chewed betel (97%). Participants blood group were as follows: O + = 42, A + = 22, B + = 28, AB + = 07, and O - = 01. All participants except 02 females had < 10% 10-year risk of a fatal or non-fatal cardiovascular event; the 02 females had a 10% to < 20% 10-year risk. Seventy-five per cent of the participants had a history of non-communicable diseases among their parents or siblings. The participant's mean (SD) age was 47.3 (5.1) years, ranging from 41 to 59. The mean (SD) years of residence at NPE, MOH area Anuradhapura was 28.9 (14.2) years, ranging from 4 to 54. The mean (SD) hours of sleep was 6.5 (1.1) years, ranging from 4 to 10. The Cronbach's alpha of questions representing depression, anxiety, and stress of DASS-21 was 0.8, 0.8, and 0.8 respectively, indicating good internal consistency in the responses.

Participants produced their Driving License (67%), Pregnancy Record (17%), Blood Donation Card (11%), Laboratory Report (03%), Old Boy Identity Card (01%), and Service Identity Card (01%) as evidence for their blood group. The blood group in the evidence matched the laboratory blood grouping in all participants. The O blood group had significantly fewer mean (SD) [6.2 (0.9)], and median (interquartile range) [6.0 (6.0-7.0)] hours of sleep per day than the non-O blood group [6.8 (1.2)], 7.0 (6.0-8.0) (P=0.03). Also, the O blood group had a significantly narrower mean (SD) [39.4 (5.1)], and median (interquartile range) [40.0 (40.0-40.0)] mmHg pulse pressure than the non-O blood group [42.0 (4.3)], 40.0 (40.0-40.0) (*P*=0.02) (Table 1). Further, the O+blood group had significantly fewer mean (SD) [6.3 (0.9)], and median (interquartile range) [6.0 (6.0-7.0)] hours of sleep per day than the A + group [7.2 (1.2)], 7.5 (6.0–8.0) (P < 0.01) (Table 2).

## Discussion

All evidence produced by study participants for their blood group (Driving License, Pregnancy Record, Blood Donation Card, Laboratory Report, Old Boy Identity Card, and Service Identity Card) matched the laboratory blood grouping. Thus, this evidence could be used as reliable documents to verify blood groups of individuals in future blood group-related research. The O blood group had significantly fewer hours of sleep per day than the non-O blood group. Also, the O+blood group had significantly fewer hours of sleep per day than the A + blood group. Further, the O blood group had a significantly narrower pulse pressure than the non-O blood group. Evidence in the literature is scarce to support these preliminary study findings. Future large-scale studies among healthy and patient populations are necessary for confirmation. Nevertheless, both short and long sleep are associated with cardiometabolic risk [23, 24]. Moreover, pulse pressure is a significant risk factor for heart disease and a 20% increase in cardiovascular risk is attributed to a 10 mmHg increase in pulse pressure [25]. The present preliminary study among healthy dwellers did not find a significant difference in cardiovascular and mental health indices between the blood groups. However, metabolic disorders such as hypertension [26], dyslipidaemia [27] and diabetes mellitus [28] are reported to have an association with ABO/Rh blood systems worldwide. Non-O blood groups have an increased risk of cardiovascular mortality [29] and are identified as risk factors for coronary artery disease [30]. Ischemic stroke was common among patients with the AB blood group [31]. The A blood group and Rh-positive blood groups were more commonly observed in patients with rheumatic diseases [32]. Also, the B blood group has a high risk of developing type 2 diabetes mellitus [33]. Further, preeclampsia is more likely among pregnant mothers with AB blood group [34]. A decreased risk of kidney stones has been

No	Item	O blood group (n = 43) Mean (SD) and Median (IQR)	non-O blood group (n = 57) Mean (SD) and Median (IQR)	<i>p</i> -value of Mann Whitney U test
1	Age (years)	47.3 (5.5) 46.0 (43.0–51.0)	47.2 (4.7) 47.0 (44.0–52.0)	0.76
2	Duration of stay at Anuradhapura (years)	28.5 (14.5) 25.0 (16.0–43.0)	29.2 (14.2) 30.0 (18.0–43.0)	0.91
3	Hours of sleep per day	6.2 (0.9) 6.0 (6.0–7.0)	6.8 (1.2) 7.0 (6.0–8.0)	0.03
4	Demi-span (cm)	87.9 (5.1) 88.0 (84.0–92.0)	86.0 (4.9) 86.0 (82.0–89.0)	0.07
5	Weight (kg)	68.6 (9.9) 68.6 (61.8–74.9)	67.4 (10.3) 67.1 (60.5–74.7)	0.55
6	Height (cm)	163.5 (8.3) 163.1 (158.1–171.0)	162.2 (7.9) 163.0 (155.4-167.2)	0.44
7	Body Mass Index (kgm <sup>-2</sup> )	25.6 (2.8) 25.5 (23.8–27.7)	25.6 (3.6) 25.4 (23.5–27.9)	0.87
8	Waist circumference (cm)	87.6 (6.6) 87.0 (83.0-92.5)	87.7 (8.2) 88.0 (81.0–93.0)	0.98
9	Hip circumference (cm)	102.7 (6.0) 103.0 (99.0-105.0)	102.0 (6.4) 102.0 (99.0-105.0)	0.61
10	Waist/Hip ratio	0.2 (0.0) 0.2 (0.2–0.3)	0.3 (0.0) 0.3 (0.2–0.3)	0.92
11	Heart rate (per minute)	67.6 (4.5) 68.0 (64.0–72.0)	67.2 (5.3) 64.0 (64.0–72.0)	0.43
12	Systolic blood pressure (mmHg)	114.9 (11.5) 120.0 (110.0-125.0)	117.7 (8.6) 120.0 (110.0-125.0)	0.35
13	Diastolic blood pressure (mmHg)	75.5 (9.5) 70.0 (70.0–85.0)	75.7 (8.6) 70.0 (70.0–80.0)	0.97
14	Pulse pressure (mmHg)	39.4 (5.1) 40.0 (40.0–40.0)	42.0 (4.3) 40.0 (40.0–40.0)	0.02
15	Mean arterial blood pressure (mmHg)	88.6 (9.9) 86.7 (83.3–98.3)	89.7 (8.4) 86.7 (83.3–96.7)	0.56
16	Depression score (Depression Anxiety Stress Scale-21)	3.7 (3.3) 3.0 (1.0–5.0)	3.3 (3.6) 3.0 (1.0–5.0)	0.41
17	Anxiety score (Depression Anxiety Stress Scale-21)	3.3 (3.9) 2.0 (1.0–5.0)	3.4 (3.8) 2.0 (1.0–5.0)	0.72
18	Stress score (Depression Anxiety Stress Scale-21)	5.9 (3.8) 6.0 (3.0-7.5)	5.8 (4.3) 5.0 (3.0–8.0)	0.76
19	HbA1C (%)	5.4 (1.3) 5.2 (5.0-5.4)	5.5 (0.9) 5.4 (5.0-5.6)	0.18
20	Total cholesterol (mg/dl)	209.1 (36.0) 206.0 (187.5-228.5)	211.7 (34.0) 207.0 (188.0-238.0)	0.78
21	Serum creatinine (mg/dl)	0.8 (0.2) 0.8 (0.6-1.0)	0.8 (0.2) 0.8 (0.7-1.0)	0.48
22	Estimated glomerular filtration rate (ml/ min/1.73m <sup>2</sup> )	101.3 (13.5) 107.0 (92.5–111.0)	99.3 (12.9) 102.0 (91.0-110.0)	0.36

## Table 1 Comparison of variables between the O blood group and the non-O blood group

Italic values indicate significance with a p-value of < 0.05

reported among people with blood group B than blood group O [35]. Non-O blood groups are associated with pancreatic cancer [36], male breast cancer [37], pediatric primary brain tumours [38], and multiple myeloma [39]. Moreover, non-O and Rh-positive blood status are implicated in SARS-CoV-2 infection [40]. A Sri Lankan study found the O blood group to be relatively resistant to the severe disease of *Plasmodium falciparum* infection [41]. A few studies have found AB blood type to be associated with anxiety and cognitive impairment; O blood type with bipolar or unipolar affective disorder and A blood type with involutional depression [42]. Also, ABO blood groups had a significant association with demi-span [43]. However, ABO/Rh blood systems did not influence mortality or morbidity in a critically ill patient population

#### No Item O+blood group A+blood group B+blood groupOther (AB + and O-) Kruskal-Wallis Significant (n = 42)(n = 22)(n = 28)blood groups (n = 08) P value pairs found (Cohen d effrom Dunn's Mean (SD) and Mean (SD) and Mean (SD) and Mean (SD) and Me-Median (IOR) Median (IOR) Median (IOR) dian (IQR) fect size) test 1 47.1 (4.4) 46.8 (4.7) 48.9 (5.9) 0.79 NA Age (years) 47.4 (5.6) 46.0 (43.8-49.0) (-0.02) 46.0 (43.0-51.5) 47.0 (43.5-48.8) 47.5 (43.8-53.3) 2 Duration of stay at Anuradha-28.6 (14.6) 31.8 (14.3) 27.9 (14.6) 26.3 (11.9) 0.68 NA pura (years) 25.0 (16.0-43.0) 33.0 (20.8-44.5) 24.5 (16.5-42.3) 23.0 (17.3-32.5) (-0.02)O + vs. A +3 Hours of sleep per day 6.3 (0.9) 7.2 (1.2) 6.5 (1.1) 6.4 (1.2) 0.02 6.0 (6.0-7.0) 7.5 (6.0-8.0) 6.0 (6.0-7.0) 6.0 (6.0-7.3) (0.08) (< 0.01) 4 Demi-span (cm) 88.0 (5.1) 86.4 (4.7) 85.6 (5.2) 85.9 (5.0) 0.22 NA 88.5 (84.0-92.0) 86.5 (83.3-88.0) (0.02) 86.0 (81.0-89.3) 88.0 (81.8-88.3) 65.1 (8.0) 0.47 NA 5 Weight (kg) 68.9 (9.8) 65.4 (9.7) 69.2 (11.2) 69.1 (62.1-75.0) 66.8 (55.8-73.7) 68.3 (62.3-77.4) 64.3 (59.4-70.3) (<-0.01) Height (cm) 0.67 6 163.7 (8.3) 161.6 (7.5) 162.0 (8.3) 163.6 (8.3) NA 164.8 (156.3-169.0) (-0.02) 1637 1613 163.0 (158.3 - 171.0)(156.1-166.6) (154.9-167.4) 7 Body Mass Index (kgm<sup>-2</sup>) 25.7 (2.8) 25.1 (3.6) 26.4 (3.8) 24.3 (2.0) 0.38 NA 25.6 (24.1-27.7) 25.0 (22.6-27.5) 26.0 (24.0-29.0) 24.5 (23.2-25.7) (< 0.01) 8 Waist circumference (cm) 87.8 (6.5) 87.2 (8.8) 87.9 (8.2) 87.4 (7.7) 0.99 NA 90.0 (79.5-93.0) 87.0 (80.5-92.8) 87.5 (83.0-92.8) (-0.03) 87.5 (83.3-93.8) 103.1 (7.7) 9 Hip circumference (cm) 102.8 (6.0) 101.0 (5.0) 100.3 (3.3) 0.39 NA 103.0 101.0 103.0 100.0 (97.8-102.5) (<-0.01) (99.3-105.0) (98.3-104.8) (99.8-107.0) Waist/Hip ratio 0.2 (0.0) 0.3 (0.0) 0.47 NA 10 0.2 (0.0) 0.2 (0.0) 0.3 (0.2-0.3) 0.3 (0.2-0.3) 0.3 (0.2-0.3) 0.2 (0.2-0.2) (-0.01) 11 Heart rate (per minute) 67.7 (4.5) 66.5 (4.0) 67.4 (6.1) 67.8 (6.0) 0.80 NA 68.0 (64.0-72.0) 64.0 (64.0-68.0) 67.0 (63.5-72.0) (-0.02)64.0 (63.5-72.0) Systolic blood pressure 117.7 (8.7) 117.7 (8.4) 115.6 (11.2) 0.91 NA 12 1152(114)(mmHg) 120.0 120.0 120.0 120.0 (107.5-121.3) (-0.03)(110.0-125.0) (110.0-120.0) (110.0-125.0) Diastolic blood pressure 75.8 (9.3) 0.99 NA 13 75.5 (9.1) 75.5 (8.0) 75.0 (11.6) 70.0 (70.0-80.0) 70.0 (70.0-80.0) (-0.03) (mmHg) 75.0 (70.0-85.0) 75.0 (67.5-85.0) 14 Pulse pressure (mmHg) 39.4 (5.2) 423(43) 42.1 (4.4) 406(42) 0.08 NA 40.0 (40.0-40.0) 40.0 (40.0-40.0) 40.0 (40.0-40.0) 40.0 (40.0-40.0) (0.04)89.0 (9.7) 89.5 (8.7) 0.99 15 Mean arterial blood pressure 89.6 (7.9) 88.5 (11.3) NA 88.3 (83.3-98.3) 86.7 (83.3-93.3) 86.7 (83.3–94.2) (-0.03) (mmHg) 90.0 (80.8-97.1) 16 Depression score (Depression 3.7 (3.3) 2.5 (2.9) 4.1 (4.1) 2.6 (2.8) 0.20 NA Anxiety Stress Scale-21) 3.0 (1.0-5.0) 1.5 (0.0-4.0) 4.0 (1.8-5.0) 2.0 (1.0-3.0) (0.02) 17 Anxiety score (Depression 3.3 (3.9) 2.6 (4.0) 4.1 (3.8) 3.0 (3.0) 0.25 NA Anxiety Stress Scale-21) 1.5 (0.0-2.8) 3.0 (1.0-5.5) 3.0 (0.8-3.5) (0.01)2.0 (1.0-5.0) Stress score (Depression Anxi-5.9 (3.8) 5.1 (3.6) 6.5 (4.6) 5.5 (4.7) 0.76 NA 18 ety Stress Scale-21) 5.5 (3.0-7.8) 5.0 (2.3-7.0) 6.0 (3.8-8.0) 4.5 (2.5-6.8) (-0.02) 19 HbA1C (%) 5.5(1.3)5.5(1.2)5.6 (0.7) 5.1 (0.5) 0.10 NA 5.2 (4.9-5.4) 5.4 (5.0-5.6) 5.5 (5.2-5.7) 5.0 (4.9-5.3) (0.03)Total cholesterol (mg/dl) 209.7 (36.2) 210.6 (42.1) 214.4 (30.7) 202.0 (14.8) 0.81 NA 20 207.0 (189.8-215.0 203.5 (187.5-212.8) (-0.02) 203.0 231.3) (177.5-239.5) (191.5 - 243.0)0.8 (0.2) 0.8 (0.2) 0.8 (0.2) 0.98 NA 21 Serum creatinine (mg/dl) 0.8 (0.3) 0.9 (0.7-0.9) 0.8 (0.7-0.9) 0.8 (0.6-1.0) 0.8 (0.7-1.0) (-0.03)22 Estimated glomerular filtration 101.0 (13.4) 101.2 (10.1) 99.3 (13.2) 96.5 (19.9) 0.95 NA rate $(ml/min/1.73m^2)$ 101.5 101.0 (83.8-112.0) (-0.03)106.5 106.5 (92.5-109.0) (91.8-110.3) (91.8-111.0)

### Table 2 Comparison of variables between the four ABO blood groups

Italic values indicate significance with a p-value of < 0.05

[44]. And, ABO blood groups were not associated with ulcerative colitis [45].

## Limitations

The findings of a preliminary study involving only healthy dwellers from one Medical Officer of Health area cannot be generalised nor could it establish a causal association. Future large-scale studies among healthy and patient populations are necessary for confirmation. Also, there could be recall bias in reporting hours of sleep. A prospective study with a recall diary to record the sleep and weak-up time could be ideal. Nevertheless, the findings of the preliminary study are unique and provide useful baseline information for future studies related to ABO blood groups and health indices.

#### Abbreviations

CKD-EPI	Chronic Kidney Disease Epidemiology Collaboration
DASS	Depression Anxiety Stress Scale
eGFR	estimated glomerular filtration rate
MOH	Medical Officer of Health
NPE	Nuwaragampalatha East
Rh	Rhesus

## Supplementary Information

The online version contains supplementary material available at https://doi.or g/10.1186/s13104-025-07227-x.

 $\mbox{Additional file 1}$  Title of data: datasheet, description of data: contains the data of the study

#### Acknowledgements

## Not applicable.

Tables.

Table 1 - Comparison of variables between the O blood group and the non-O blood group. Table 2 - Comparison of variables between the four ABO blood groups

### Author contributions

DR conceived the idea of the study and designed the study. DR was involved in the data collection and analysis of the study. DR did data interpretation. DR drafted the manuscript and critically revised it. DR read and approved the final version of the manuscript.

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#### Data availability

All data generated or analysed during this study are included in this published article and its supplementary information file.

## Declarations

### Ethics approval and consent to participate

Ethical clearance was obtained from the Ethics Review Committee of the Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka (ERC/2024/52). Informed written consent was obtained from all participants. The study was performed in accordance with the Declaration of Helsinki. All methods were carried out in accordance with relevant guidelines and regulations. All necessary measures were taken to preserve the participant's privacy and confidentiality.

#### **Consent for publication**

Not applicable.

#### **Competing interests**

The authors declare no competing interests.

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