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RESEARCH ARTICLE

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The relationship between platelet indices and ABO blood groups in healthy adults

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Background: ABO blood groups have been suggested to have a high correlation with cardiovascular diseases (CVDs). It has also been postulated that platelet indices, including mean platelet volume (MPV) and platelet distribution width (PDW), are very important in the development and progression of CVDs. However, despite these common associations with CVDs, as far as we know, there are no studies investigating platelet indices in ABO blood groups. Thus, the aim of this study was to investigate whether platelet indices are associated with ABO blood groups.

Methods: The study included 301 healthy volunteers (99 women and 202 men; mean age: 32.59 ± 7.52 years) whose blood groups were determined by the gel column method using agglutination techniques. Platelet indices were studied by an automated blood counter.

Results: No considerable differences in age, gender, or Rh factors were observed among ABO blood groups. MPV was detected to be considerably lower in O and A blood group subjects than in AB and B blood group subjects. Similarly, PDW was significantly lower in O and A blood group subjects than in B blood group subjects. Additionally, MPV in the O blood group subjects was significantly lower than in the non-O blood group subjects.

Conclusions: Because MPV and PDW are used as markers of CVDs, individuals with O and A blood groups in this study may be considered to have a lower risk of CVDs than AB and B blood group subjects. However, prospective cohort studies involving a greater number of volunteers are needed to elucidate these relationships.

KEYWORDS

ABO blood groups, cardiovascular diseases, mean platelet volume, platelet distribution width, platelet indices

1 | INTRODUCTION

Some red blood cells have A and/or B antigens on their surface, and blood groups are identified according these antigen types. If the red blood cells have no A or B antigens, the blood type is called the O blood group. Many studies have investigated whether there is any relationship between ABO blood groups and cardiovascular diseases (CVDs).[1-4] Non-O blood groups—in particular, the A blood group—were found to be associated with ischemic heart disease and atherosclerotic CVD.[4,5] Many different studies have declared that non-O blood groups have increased von Willebrand factor and coagulation factor VIII levels, and these increased levels could lead to cardiac and thromboembolic diseases.[6,7] Thromboembolic disorders can lead to ischemic heart disease, stroke, and systemic organ failure. These pathologies negatively affect life quality and may lead to mortality. Studies have also reported that non-O blood group

TABLE 1 Comparison of demographic data among ABO blood group subjects

	ABO blood group phenotypes				
	A (n = 87)	B (n = 72)	AB (n = 61)	O (n = 81)	ANOVA *P*
Age (y)	31.83 ± 7.33	31.6 ± 27.40	33.97 ± 7.10	33.22 ± 8.05	0.196
Gender (female)	25 (28.7%)	24 (33.3%)	25 (41.0%)	25 (30.9%)	0.449
BMI (kg/m^2)	24.24 ± 1.59	24.20 ± 1.83	23.79 ± 1.71	23.78 ± 1.69	0.173
Rh factor (Rh +)	44 (50.6%)	42 (58.3%)	34 (55.7%)	36 (44.4%)	0.332

individuals had higher total cholesterol and low-density lipoprotein cholesterol levels[8] and cholesterol absorption rates[9] than did O blood group individuals, leading to atherosclerotic plaque progression and an increased risk of coronary artery disease (CAD) and myocardial infarction (MI).[5]

Platelet indices, including mean platelet volume (MPV) and platelet distribution width (PDW), are potential biomarkers of CVDs.[10] These different markers give information about platelet sizes and platelet functions.[11,12] During activation, the platelet size tends to increase, and the platelets become hemostatically more active than small platelets.[12,13] MPV, usually used to measure the platelet size, is an important biomarker of platelet activation and function.[12] In previous studies, increased MPV was demonstrated in patients with thromboembolic and atherosclerotic CAD.[14-16] The PDW measures the variability in platelet size.[17,18] Although MPV is currently the most widely used indicator of platelet activation, PDW has previously been used as a marker of platelet activation.[18] A high PDW indicates that the platelets are more variable in volume and more reactive than normal.[17]

The studies mentioned above have shown that both ABO blood groups and platelet indices are associated with ischemic, atherosclerotic, and thromboembolic CVDs. However, as far as we know from the literature, no studies have clarified the relationship between ABO blood groups and platelet indices. For this reason, we sought to express the relationship between ABO blood groups and platelet indices in a healthy adult population.

2 | MATERIALS AND METHODS

2.1 | Subjects

This study included 301 healthy volunteers (99 women and 202 men; mean age: 32.59 ± 7.52 years; body mass index [BMI]: 24.01 ± 1.69 kg/m^2) who applied to the Cardiology Outpatient Clinic of Harran University medical faculty, with atypical chest pain, and who were referred to the Internal Medicine Polyclinic of Yuzuncu Yıl University medical faculty, because of dyspeptic complaints.

The clinical risk factors, smoking status, and other demographic data of all the participants were recorded from hospital registries. The subjects who had malign hematological disorders, were using of anticoagulants or oral contraceptives, or had a history of thromboembolic events, hypertension, diabetes mellitus, hyperlipidemia, chronic respiratory insufficiency, liver and renal disease, CAD, or cerebrovascular disease were not included in the research. Participants were not smoking or drinking and were not taking vitamin therapy.

Written informed consent was obtained from all participants whose blood groups had been worked before, and the study protocol was approved by the Local Ethics Committee of Harran University.

2.2 | Blood collection and platelet indices measurement

Venous blood samples were collected from each participant after at least 8 hours of overnight fasting. The blood samples were taken in tubes containing ethylenediaminetetraacetic acid. To prevent in vitro platelet activation, all the measurements were performed immediately after the blood collection. Platelet count (PLT), MPV, PDW, and plateletcrit (PCT) were studied by an auto-analyzer (Abbott Cell-Dyn Ruby Hematology Analyzer, USA). Blood groups were determined by the gel column blood typing method using agglutination techniques.

2.3 | Statistical analysis

Statistical analyses were conducted with SPSS for Windows version 23.0 software (IBM SPSS Inc, Chicago, IL, USA). The Shapiro-Wilk test was used to evaluate the normal distribution of the data, and all the data were found to be normally distributed. Numerical variables were presented as mean ± standard deviation, and categorical variables were stated as number (n) and percentage (%). A two-sample comparison of numerical variables was conducted by an unpaired Student's *t* test, and multiple comparisons of numerical variables were conducted by analysis of variance (two-way ANOVA, Bonferroni's post hoc test). The chi-square test was also used to compare categorical variables. The confidence interval was accepted as 95% throughout the analyses. A two-tailed *P* value of <0.05 was considered statistically significant.

3 | RESULTS

The demographic characteristics of the enrolled subjects are summarized in Table 1. There were no significant differences with respect to age, gender, BMI, or Rh factors among ABO blood group subjects ($P > 0.05$ for each).

The comparison of alterations in platelet indices among ABO blood group subjects is presented in Table 2 and in Figures 1 and 2.

TABLE 2 Comparison of platelet indices among ABO blood group subjects

	ABO blood group phenotypes				
	A (n = 87)	B (n = 72)	AB (n = 61)	O (n = 81)	ANOVA *P*
PLT (×10^3/μL)	267.7 ± 61.4	265.4 ± 58.4	262.6 ± 58.5	275.0 ± 50.3	0.606
PCT (%)	0.198 ± 0.041	0.209 ± 0.043	0.211 ± 0.052	0.202 ± 0.042	0.209
MPV (fL)	7.498 ± 0.919[†]	7.916 ± 1.243	8.031 ± 1.491	7.376 ± 1.023[‡]	0.001
PDW (fL)	19.22 ± 1.20[§]	19.66 ± 1.05	19.37 ± 1.21	19.13 ± 1.18[¶]	0.033

Values are mean ± SD.
MPV, mean platelet volume; PCT, plateletcrit; PDW, platelet distribution width; PLT, platelet count.
[†]$P < 0.05$ compared with AB and B blood groups
[‡]$P < 0.05$ compared with AB and B blood groups
[§]$P < 0.05$ compared with B blood groups
[¶]$P < 0.05$ compared with B blood groups

MPV was found to be significantly lower in both O and A blood group subjects than in B and AB blood group subjects ($P < 0.05$ for each). Additionally, PDW was detected to be considerably lower in O and A blood group subjects than in B blood group subjects ($P < 0.006$ and $P < 0.019$, respectively). However, no considerable differences with respect to PLT and PCT among ABO blood group subjects were detected ($P > 0.05$ for each).

The platelet indices of O blood group subjects and non-O blood groups are compared in Table 3 and Figure 3. MPV values were found to be considerably lower in O blood group subjects than in non-O blood group subjects ($P = 0.008$). However, there were no significant differences between O blood group subjects and non-O blood group subjects in terms of PLT, PCT, or PDW ($P > 0.05$).

4 | DISCUSSION

Although there is a confirmed association between ABO blood groups and CVDs[1-4] and between platelet indices and thromboembolic and atherosclerotic CVD,[11,14-16] to the best of our knowledge, there is no study that addresses the relationship between platelet indices and CVDs in healthy adults. Hence, we aimed to investigate whether MPV and PDW, two important indicators of platelet activity, had relationships with ABO blood groups in healthy adult subjects.

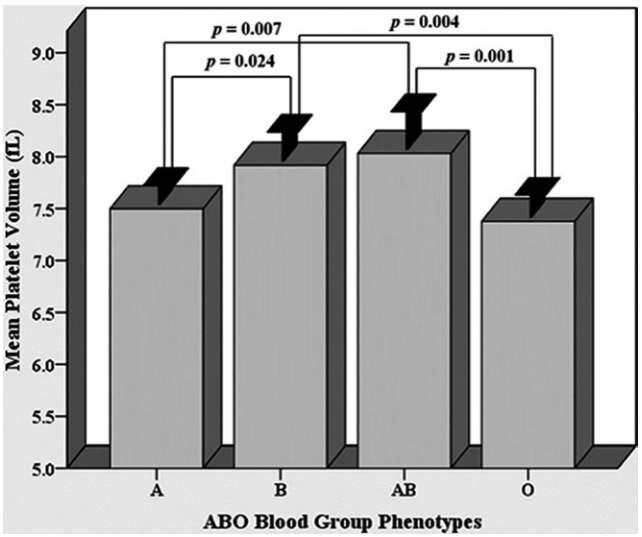

FIGURE 1 Comparison of mean platelet volume among ABO blood group subjects

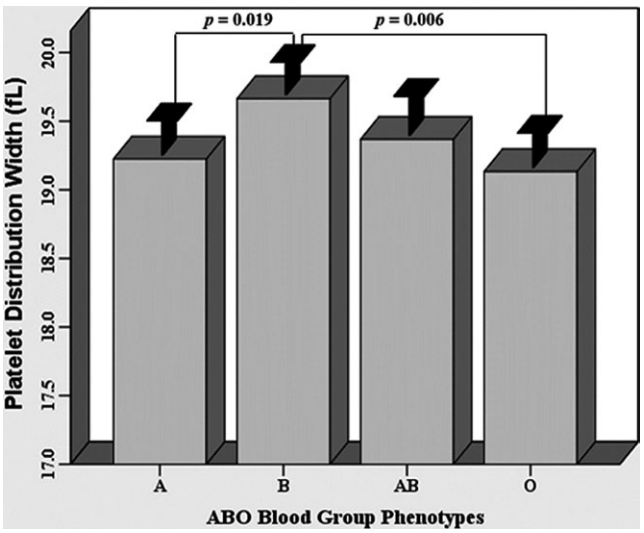

FIGURE 2 Comparison of platelet distribution width among ABO blood group subjects

TABLE 3 Comparison of platelet indices between O blood group subjects and non-O blood group subjects

	ABO blood group phenotypes		
	Non-O (n = 220)	O (n = 81)	*P* Values
PLT (×10^3/μL)	265.5 ± 59.3	275.0 ± 50.3	0.204
PCT (%)	0.205 ± 0.045	0.202 ± 0.042	0.499
MPV (fL)	7.783 ± 1.215	7.376 ± 1.023	0.008
PDW (fL)	19.41 ± 1.15	19.13 ± 1.18	0.067

Values are mean ± SD.
MPV, mean platelet volume; PCT, plateletcrit; PDW, platelet distribution width; PLT, platelet count.

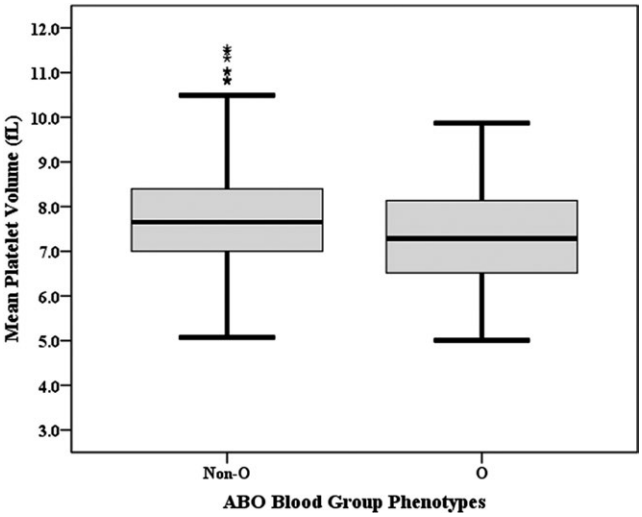

FIGURE 3 Comparison of mean MPV between O blood group subjects and non-O blood group subjects

Studies have elucidated that non-O blood group subjects have a higher coronary heart disease risk[19] and increased atherosclerotic cardiovascular mortality[20] compared with O blood group subjects. It has also been detected that there is a lower incidence of coronary heart disease in O blood group subjects as compared with A blood group subjects in Western countries.[2,21] Similarly, some authors have argued that there is a high correlation between MPV and CVDs.[11,15,22] Besides, this biomarker could be an early predictive factor for cardiac diseases and could give information for prognosis of the pathology.[16,23,24] Also, Cetin et al found a relationship between MPV and thrombolysis failure in patients with ST-segment elevation MI.[25] In relation to these studies, we found that O blood group subjects have considerably decreased MPV levels than do B and AB blood group subjects ($P = 0.004$ and $P = 0.001$, respectively). Moreover, in this study, MPV levels in O blood group subjects were significantly lower than MPV levels in non-O blood group subjects ($P = 0.008$). However, several other studies have reported that there is no relationship between MPV and CAD.[11,26] Similarly, Karabuva et al presented that ABO blood groups were not associated with the presence of atherosclerotic CAD.[27]

Many researchers investigated the association between blood groups and skin diseases. Shahkar et al[28] demonstrated no relationship between ABO groups and presence of the pemphigus vulgaris. Similarly, no relationship was observed between ABO groups and Behçet's disease.[29] Beckman et al[30] stated that A-factor of ABO blood groups was found increased in the patients with psoriasis. Xie et al[31] declared that non-O blood group was associated with decreased risk of skin cancers. Beside this, there was a significant relationship between non-O blood groups and non-melanoma cancers.[31]

A systematic review and meta-analysis study conducted by Chen et al[4] indicates that risk factors for CAD are high in both A blood group subjects and non-O blood group subjects. In addition, other studies have suggested that the A blood group is an independent risk factor for coronary atherosclerosis and ischemic CVD.[2,32,33] In contrast to previous studies, MPV, a useful prognostic marker in patients with CAD and venous thrombosis, was found to be significantly lower in A blood group subjects than in B and AB blood group subjects ($P = 0.024$ and $P = 0.007$, respectively).

We also observed that PDW, an indicator of prothrombotic status,[34] was significantly higher in B blood group subjects than in A and O blood group subjects ($P = 0.019$ and $P = 0.006$, respectively). In accordance with our study, many investigations have shown that PDW was significantly higher in subjects with CAD and thrombolysis failure.[25,35-37] However, other studies have reported that there is no relationship between PDW and the extent of CAD.[11,18]

5 | CONCLUSIONS

Although a few studies have not found any relationship between platelet indices and CVDs, the vast majority of investigations have stated that platelet indices are important prognostic markers in CVDs. Hence, we argued in this study that AB and B blood group subjects may have a higher risk of CVDs than do O and A blood group subjects. However, prospective cohort studies involving more volunteers are needed to clarify the relationship between ABO blood groups and CVDs.

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