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Evaluation of Platelet Indices in Children With Celiac Disease

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ABSTRACT

Celiac disease (CD) is a systemic disorder with protean manifestations. The records of the cases we had diagnosed with CD and monitored at the pediatric clinic of the School of Medicine of the Yuzuncu Yil University (Van, Turkey) between 2010 and 2015 have been reviewed retrospectively. In this study, we aimed to evaluate platelet indices in patients with CD before gluten free diet and after gluten free diet and compare them with those obtained in healthy control subjects. To the best of our knowledge, MPV, PDW and PCT together have not been studied previously in patients with CD.

The study included 79 children with CD. A diagnosis of CD was established by positive antibodies against gliadin and/or endomysium and confirmed with histological findings of duodenum biopsy based on modified Marsh classification

MPV was higher in patients with CD after gluten free diet compared with controls. There was not a significant difference in terms of MPV between the controls and the patient group after the treatment. Following the gluten free diet, we found a decrease in platelet count values from the patient group before the gluten free diet. There was not a significant difference in terms of platelet counts, MPV, PDW, and PCT between the patient group before the gluten free diet and after the gluten free diet.

Our study demonstrated that was not a statistically significant difference in terms of platelet indices between the controls and the patient both CD group.

Keywords: Coeliac disease, Mean platelet volume, Platelet indices

Introduction

Celiac disease (CD) is a chronic, immune-mediated systemic disorder that develops in genetically susceptible individuals following exposure to gluten-containing cereals, including wheat, barley, and rye. The disease is characterised by small-intestinal mucosal inflammation and injury, which may impair nutrient absorption and cause both gastrointestinal and extraintestinal manifestations (1,2). Despite advances in the understanding of CD pathogenesis and clinical heterogeneity, lifelong strict adherence to a gluten-free diet remains the only established treatment. A gluten-free diet generally promotes clinical, serological, and nutritional recovery; however, sustained dietary adherence requires structured education and follow-up, particularly in paediatric patients (3).

Platelets contribute to inflammatory processes by releasing cytokines, chemokines, and procoagulant mediators (4). Platelet-related parameters obtained from routine complete blood counts, including platelet count, platelet distribution width (PDW), mean platelet volume (MPV), and plateletcrit (PCT), may provide indirect information on platelet activation and systemic inflammation (5). MPV reflects the average platelet size and is commonly considered a surrogate marker of platelet production and activation (6). Alterations in MPV have been described in several inflammatory disorders, including ulcerative colitis, acute pancreatitis, and CD (7–10). Nevertheless, the association between platelet indices and CD remains incompletely understood, and the available findings are inconsistent across study populations. A recent study reported higher MPV values in patients with active CD than in healthy controls and showed that MPV decreased in patients adhering to a gluten-free diet; however, this evidence was derived from an adult cohort and requires confirmation in pediatric populations (11).

Materials and Methods

The records of the cases of CD diagnosed and monitored at the pediatric clinic of the School of Medicine of the Yuzuncu Yil University (Van, Turkey) between 2010 and 2015 were retrospectively reviewed. This study included 79 children with CD. A diagnosis of CD was established based on positive antibodies against gliadin and/or endomysium and confirmed with histological findings of duodenal biopsy based on the modified Marsh classification (7).

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Demographic features of the patients were extracted from the patient data. CBC, including white blood cell (WBC) and platelet counts, MPV, and PDW, were collected at the time of diagnosis and after 1 year of gluten-free diet for CD using a computerized patient database. Acute or chronic infection, malignancy, hematologic disorders, and a history of drug use were the exclusion criteria of the study. Eleven patients with CD were excluded from the study for not complying with the diet. A total of 68 age - and sex-matched healthy children constituted the control group. The complete blood count parameters of healthy children were recorded from the same computerized data system. The control group consisted of patients who were diagnosed with functional gastrointestinal disorders, all of whom had normal CBCs and were negative for antibodies against gliadin and endomysium.

The blood specimens were placed into ethylene diamine tetra acetic acid (EDTA)-acid-containing tubes, kept at room temperature, and within 1 h, were assessed for platelet count and indices [MPV, PDW, and PCT] using an LH-780 model Coulter Counter Analyzer (Coulter Electronics, Hialeah, FL). To calculate the PCT, the formula, platelet count × MPV/10^3, was used (e.g., a platelet count of 80 x 10^9/l and MPV of 8 fl yields a platelet mass of 640 fl/nl). The study was approved by the Clinical Research Ethics Committee of Yuzuncu Yil University (Approval No: 2026/02-08; Approval Date: February 20, 2026).

Adherence to the gluten-free diet was assessed through dietary history obtained from patients and their caregivers during follow-up visits. Eleven patients with documented poor dietary adherence were excluded from the longitudinal analysis.

Statistical Analysis: Descriptive statistics were used to summarize the demographic and hematological characteristics of the study population. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables were presented as frequencies and percentages. The normality of continuous variables was assessed using the Shapiro–Wilk test. Differences in continuous variables between children with celiac disease and the control group were evaluated using two-sided Welch's t-tests. Categorical variables were compared using Pearson's chi-square test. Within-patient comparisons of platelet count, MPV, PDW, and PCT before and after one year of a gluten-free diet were performed using the paired-samples t-test for normally distributed differences or the Wilcoxon signed-rank test for non-normally distributed differences. Exact p-values were reported, and a two-sided p-value of less than 0.05 was considered statistically significant. Statistical non-significance was not interpreted as evidence of equivalence between groups.

Results

A total of 79 children diagnosed with celiac disease were initially evaluated. Eleven patients were excluded because of poor adherence to the gluten-free diet (GFD), leaving 68 patients for the final analysis. The control group consisted of 68 children.

Among the patients with celiac disease, 40 (58.8%) were male and 28 (41.2%) were female, compared with 43 (63.2%) males and 25 (36.8%) females in the control group ($p = 0.598$). The mean age of patients was 8.4 ± 4.7 years at diagnosis and 9.4 ± 4.7 years after one year of GFD, compared with 8.1 ± 3.6 years in the control group. The between-group age comparisons were not statistically significant ($p = 0.677$ and $p = 0.073$, respectively).

The mean platelet count was 339,676 ± 123,050/mm^3 before GFD and 307,666 ± 78,166/mm^3 after GFD, compared with 314,117 ± 67,464/mm^3 in controls. Neither the baseline nor the follow-up platelet count differed significantly from that of controls ($p = 0.136$ and $p = 0.607$, respectively).

Mean platelet volume (MPV) was 8.10 ± 0.9 fL before GFD, 8.15 ± 1.0 fL after GFD, and 8.03 ± 0.8 fL in controls. The corresponding between-group p-values were 0.632 and 0.441.

Platelet distribution width (PDW) was 15.7 ± 1.6% at diagnosis, 15.2 ± 2.4% after GFD, and 15.4 ± 2.4% in controls. The corresponding p-values were 0.393 and 0.628.

Plateletcrit (PCT) values were 2731 ± 969 before GFD, 2471 ± 621 after GFD, and 2491 ± 517 in controls. The corresponding between-group p-values were 0.075 and 0.839 (Table 1).

Platelet indices were evaluated in 68 children with celiac disease before and after one year of a gluten-free diet. Mean platelet count decreased from 339,676 ± 123,050/mm^3 to 307,666 ± 78,166/mm^3 ($p = 0.051$). MPV showed a slight increase from 8.10 ± 0.9 fL to 8.15 ± 1.0 fL ($p = 0.681$). PDW decreased from 15.7 ± 1.6% to 15.2 ± 2.4% ($p = 0.128$), while PCT decreased from 2731 ± 969 to 2471 ± 621 ($p = 0.067$).

Discussion

In the present study, we evaluated platelet count, mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT) in children with celiac disease before and after one year of a gluten-free diet and compared these parameters with those

Table 1: The Characteristics of Patients With CD and Healthy Controls

Characteristics	Before GFD (n=68)	After GFD (n=68)	Controls (n=68)	p^1	p^2
Male/Female	40/28	40/28	43/25	0.598	0.598
Age (years)	8.4 ± 4.7	9.4 ± 4.7	8.1 ± 3.6	0.677	0.073
Platelet count (/mm³)	339,676 ± 123,050	307,666 ± 78,166	314,117 ± 67,464	0.136	0.607
MPV (fL)	8.10 ± 0.9	8.15 ± 1.0	8.03 ± 0.8	0.632	0.441
PDW (%)	15.7 ± 1.6	15.2 ± 2.4	15.4 ± 2.4	0.393	0.628
PCT (fL/nL)	2731 ± 969	2471 ± 621	2491 ± 517	0.075	0.839

Data are presented as mean ± standard deviation (SD) or number of patients. CD: celiac disease; GFD: gluten-free diet; MPV: mean platelet volume; PDW: platelet distribution width; PCT: plateletcrit. p^1: Comparison between patients before GFD and controls. p^2: Comparison between patients after GFD and controls. p-values for continuous variables were estimated using two-sided Welch's t-tests based on summary statistics. Sex distribution was compared using Pearson's chi-square test

of a control group. Although numerical changes in platelet indices were observed during dietary follow-up, the reported comparisons did not demonstrate statistically significant differences. These findings suggest that the clinical utility of routine platelet indices as isolated markers of disease activity or dietary response in pediatric celiac disease remains uncertain.

CD is an immune-mediated enteropathy of the small intestine that may lead to malabsorption and a broad range of nutritional and hematological abnormalities. Although knowledge of its pathophysiology and clinical spectrum has expanded substantially, strict and lifelong adherence to a gluten-free diet remains the cornerstone of treatment. Recent pediatric guidelines also emphasize the importance of structured dietary follow-up to ensure adequate adherence and nutritional recovery (3,12).

MPV has attracted attention as a potential indicator of platelet activation and systemic inflammation. Alterations in MPV have been reported in several inflammatory disorders, including Crohn's disease, ulcerative colitis, chronic hepatitis B, and acute pancreatitis (6,13,14). Nevertheless, data on MPV in children with CD remain scarce. O'Grady et al (15) assessed platelet count and platelet volume in 84 splenectomized individuals, 142 patients with CD, and 77 healthy controls. They identified an inverse, nonlinear association between platelet count and platelet volume in both healthy participants and patients with CD; this relationship was not observed in splenectomized individuals. In addition, splenectomized subjects had significantly higher platelet counts and MPV values than healthy controls ($p = 0.0001$ for both comparisons). Platelet counts were also associated with splenic function among patients with CD and were significantly higher in those with severe hyposplenism than in normosplenic patients ($p = 0.0001$). Although splenic function did not significantly affect MPV in CD, normosplenic patients had higher MPV values than healthy controls. These findings suggest that splenic function may influence platelet count in CD and both platelet count and volume in healthy individuals (15).

In another study, Purnak et al. (7) evaluated 60 newly diagnosed patients with CD and 40 healthy controls. The MPV was significantly higher in the CD group than in the control group (8.45 ± 0.96 fL vs. 7.93 ± 0.63 fL; $p = 0.004$). Among patients who initiated a gluten-free diet, those who adhered to the diet had lower MPV values than those who did not (8.09 ± 0.60 fL vs. 8.90 ± 1.08 fL; $p = 0.001$). In addition, MPV decreased significantly after dietary treatment in the adherent group, whereas it increased during follow-up among non-adherent patients. Recently, Gerçeker et al. reported higher MPV values in patients with CD than in healthy controls and observed lower MPV values among individuals who adhered to a gluten-free diet. They also found that MPV increased with greater histological disease severity, suggesting that MPV may reflect disease activity and dietary adherence in some patients (11).

In the present study, MPV values were numerically higher in patients with CD, both before and after the introduction of a gluten-free diet, than in healthy controls. However, neither the comparison between the pre- and post-diet CD groups nor the comparisons with the control group reached statistical significance. These results differ from those of studies reporting significantly increased MPV in CD and suggest that the relationship between MPV, intestinal inflammation, and dietary adherence may vary according to patient characteristics, disease activity, follow-up duration, and methodological factors affecting MPV measurements.

PCT is calculated from platelet count and MPV, whereas PDW reflects the variation in platelet size measured using automated hematological analyzers. Although platelet count and MPV are more frequently assessed in clinical practice, PDW and PCT may also provide information about platelet activation and inflammatory status. These indices have been investigated in several conditions, including coronary artery disease, diabetes mellitus, pulmonary tuberculosis, obstructive sleep apnea, and inflammatory disorders (5,16-18). In our cohort, platelet counts and PCT values were numerically higher before initiation of the gluten-free diet than in healthy controls. However, platelet count, PDW, and PCT did not differ significantly between either the CD group and the control group.

During the one-year follow-up period, platelet count, PDW, and PCT showed numerical decreases, whereas MPV remained relatively stable. Although these changes may reflect alterations in hematological parameters during dietary treatment, their clinical significance remains uncertain. Furthermore, because the control group was assessed at a single time point, the observed longitudinal changes cannot be attributed exclusively to the gluten-free diet. Age-related physiological changes and other unmeasured factors may also have contributed to these findings.

Overall, our findings did not identify any statistically significant differences in platelet indices between children with CD and controls, either before or after the initiation of a gluten-free diet. The retrospective design, limited sample size, and possible preanalytical variability in platelet index measurements may have influenced these results. Larger prospective studies with standardized blood sample processing, longitudinal assessment of dietary adherence, and concurrent evaluation of clinical, serological, and histological activity are needed to clarify the potential role of platelet indices in pediatric CD.

An important limitation of this study is the absence of longitudinal follow-up measurements in the control group. Although platelet indices were evaluated in children with celiac disease at diagnosis and after one year of a gluten-free diet, controls were assessed only once. Therefore, changes observed during follow-up cannot be definitively attributed to the gluten-free diet, as age-related physiological changes and regression to the mean may also have contributed. Future prospective studies incorporating longitudinally followed control groups are needed to better distinguish treatment-related effects from natural developmental changes. Another limitation is the exclusion of 11 patients with poor adherence to the gluten-free diet. Consequently, the longitudinal analysis was restricted to patients who adhered to dietary treatment, potentially introducing selection bias and overestimating favorable changes during follow-up. Furthermore, the exclusion of non-adherent patients limits the generalizability of the findings to the broader pediatric celiac disease population.

In conclusion, platelet count, MPV, PDW, and PCT did not demonstrate statistically significant differences between children with celiac disease and controls in the reported comparisons. Although changes in platelet indices were observed following one year of a gluten-free diet, their interpretation remains limited by the retrospective study design and the absence of longitudinal measurements in the control group. Further prospective studies are needed to determine whether these hematological parameters have clinical value in monitoring pediatric celiac disease.

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