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Can Mean Platelet Volume Potentially Serve as A Novel Indicator of Activity in Ankylosing Spondylitis? Can Vitamin D Level Affect Disease Activity?

Ortalama Platelet Hacmi Ankilozan Spondilitte Yeni Bir Aktivite Belirteci Olabilir mi? Vitamin D Seviyesi Hastalik Aktivitesini Etkileyebilir mi?

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ABSTRACT

Aim: In AS patients' disease activity isn't correlated with acute phase reactants. The Neutrophil/Lymphocyte Ratio (NLR) and Platelet/Lymphocyte Ratio (PLR) serve as valuable indicators for assessing inflammation. Vitamin-D deficiency could result in heightened disease activity. The aim of this study was to investigate the relationship between mean platelet volume (MPV), vitamin D and NLO, PLO, and disease activity.

Material and methods: The study comprised 112 patients and 116 controls, with retrospective data collection.

Results: Statistically significant differences were identified in the values of Vitamin-D, MPV, erythrocyte sedimentation rate (ESR), NLR, PLR, and C-reactive protein (CRP) between the patient and control groups. Except for MPV, there were no discernible differences in these values between inactive and active patients. Significantly lower MPV values were observed in patients with Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) scores of ≥4. CRP and ESR exhibited a negative correlation with MPV and a positive correlation with NLR and PLR. There was a negative correlation between BASDAI and MPV. However, no correlation was found between Vitamin-D and acute phase reactants, as well as NLR and PLR.

Conclusions: In existing studies, a definitive consensus on the connection between inflammation and Vitamin-D remains elusive, and the values of MPV also exhibit considerable variability. In our study, the Vitamin-D levels of patients were significantly higher than those of the control group, while MPV was significantly higher in the control group. No significant difference was observed between the control group and the BASDAI<4 group. However, a statistically significant difference was identified between the control group and the BASDAI≥4 group, with significantly higher MPV values observed in the control group. These findings suggest that MPV may help us as a valuable indicator for detecting inflammation. In the study, MPV demonstrated a negative correlation with BASDAI, ESR, and CRP. The results imply that MPV could be a cost-effective method aiding in the assessment of disease activity. Wider prospective studies are essential to validate the utility of this cost-effective and readily accessible parameter in disease monitoring.

Key Words: Mean Platelet Volume, Ankylosing spondylitis, Vitamin-D

ÖZ

Amaç: AS hastalarında hastalık aktivitesi, akut faz reaktanları ile ilişkili değildir. İnflamasyonu değerlendirmek için Nötrofil/Lenfosit Oranı (NLO) ve Platelet/Lenfosit Oranı (PLO) kullanılabilir. Vitamin-D eksikliği hastalık aktivitesinin artmasına neden olabilir. Biz çalışmamızda Ortalama platelet hacmi (OPH), Vitamin-D ve NLO, PLO ve hastalık aktivitesi arasındaki ilişkiyi belirlemeyi amaçladık.

Gereç ve yöntemler: 112 hasta ve 116 kontrolün dataları retrospektif olarak kaydedildi.

Bulgular: Vitamin-D, NLO, PLO, OPH, Eritrosit Sedimentasyon Hızı (ESH), C Reaktif Protein (CRP) değerlerinde hastalar ile kontrol grubu arasında istatistiksel olarak anlamlı fark tespit edildi. OPH dışında bu değerlerde aktif ve inaktif hastalar arasında fark yoktu. OPH; BASHAİ≥4 (Bath Ankilozan Spondilit Hastalık Aktivite İndeksi) hastalarda anlamlı olarak düşüktü. OPH; CRP, ESH ile negatif, NLO, PLO ile pozitif korelasyon gösterdi. BASHAİ ile OPH arasında negatif korelasyon bulunurken, Vitamin-D ile akut faz reaktanları, NLO ve PLO arasında korelasyon bulunmadı.

Sonuç: Çalışmalarda Vitamin-D ile inflamasyon arasındaki ilişki konusunda kesin bir görüş birliği yoktur ve OPH değerleri de oldukça değişkendir. Çalışmamızda hastaların Vitamin-D düzeyi kontrollere göre anlamlı olarak yüksekti; OPH ise kontrol grubunda anlamlı olarak daha yüksekti. Kontrol grubu ile BASHAİ<4 grubu arasında fark bulunmazken BASHAİ≥4 grubu ile arasında istatistik açısından anlamlı fark vardı ve kontrol grubunun OPH değerleri anlamlı olarak yüksekti. Bu bize OPH'nin inflamasyonu tespit etmemize yardımcı olabileceğini düşündürmektedir. Çalışmada OPH; BASHAİ, ESH ve CRP ile negatif korelasyon göstermektedir. OPH, hastalık aktivitesine yardımcı olabilecek ucuz bir yöntem gibi görünmektedir. Bu ucuz ve kolay elde edilen parametrenin hastalık takibinde kullanımının kabul edilebilmesi için daha geniş prospektif çalışmalara ihtiyaç vardır.

Anahtar Kelimeler: Ortalama Platelet Hacmi, Ankilozan Spondilit, Vitamin-D

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INTRODUCTION

Ankylosing spondylitis (AS) is a chronic, inflammatory autoimmune disease primarily damages the spine and sacroiliac joint (1). It especially affects young men, and when diagnosed late, ankylosing spondylitis (AS) can disrupt the professional lives of patients, leading to workforce loss and imposing an economic burden on the country.

Ankylosing spondylitis is diagnosed through a combination of clinical and radiological assessments, as there is no specific diagnostic test available. Disease activity in AS is frequently not correlated with traditional acute phase markers such as C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR). Furthermore, these markers are not specific indicators of inflammation. They can elevate in various conditions, including pregnancy, obesity, and infectious diseases, making them less specific for pinpointing inflammation. This has prompted the exploration of alternative markers to assess activity, particularly in these patients.

In studies of various diseases, systemic inflammation has found to be associated with both the composition and volume of circulating blood cells. The active participation of neutrophils, lymphocytes and platelets is important in the development of inflammation, and qualitative and quantitative changes in these cells have been recorded as a response to inflammatory processes. Platelet/lymphocyte rate (PLR) and neutrophil/lymphocyte rate (NLR) calculations have diagnostic value in evaluating the inflammatory response in patients with local or systemic inflammation, such as coronary artery disease, diabetes, inflammatory arthritis, and ulcerative colitis (2).

Mean platelet volume (MPV) is considered an indicator of platelet function and activation. High MPV values have been shown to be an independent risk factor for acute myocardial infarction, renal artery stenosis, diabetes mellitus, hypertension, and hyperlipidaemia. Additionally, MPV values are elevated in some systemic inflammatory diseases and are positively correlated with CRP (3). On the other hand, increased pro-inflammatory cytokines and acute phase reactants can suppress platelet size and decrease mean platelet volume (MPV) by affecting megakaryopoiesis and platelet release from the bone marrow (4).

Vitamin D, a fat-soluble vitamin, is synthesized from cholesterol and exhibits hormone-like functions in the body. Serum levels of 25-OH D3 are widely acknowledged as the key indicator for determining vitamin D levels in the body. Assessing individual vitamin D levels necessitates measuring 25(OH)D levels, which have a half-life of two to three weeks. This duration reflects both the endogenous production of vitamin D and the intake of exogenous vitamin D (5). Research has shown that vitamin D plays a significant role in the functions of organs beyond bone metabolism (6). In healthy people, normal serum 25(OH) D3 concentrations must be 30 ng/mL and above. Vitamin D levels below 20 mg/dl are considered vitamin D deficiency. If serum 25(OH) D3 levels are between 21-29 ng/mL, it is described as vitamin D insufficiency (5).

The identification of vitamin D receptors in active inflammatory cells in peripheral blood has brought attention to the function of vitamin D in the immune system. Vitamin D deficiency causes a decreased T-cell response (7). This shows that vitamin D is effective in T-cell development (8). T-helper 1 (Th1) cells, which create a strong immune response by increasing proinflammatory cytokine production, and T-helper 2 (Th2) cells, which are responsible for the release of anti-inflammatory cytokines, are two different types of T cells (9). Vitamin D exhibits dual effects on the immune system. On one hand, it suppresses the proliferation of Th1 cells and hinders the production of proinflammatory cytokines like interleukin-2 and interferon γ (10). On the other hand, it enhances the anti-inflammatory response by activating Th2 and Treg cell responses (11). In vitamin D deficiency, the activation of proinflammatory cytokines associated with the Th1 response contributes to the etiopathogenesis of autoimmune-based chronic diseases, including type 1 diabetes mellitus, multiple sclerosis, rheumatoid arthritis, and inflammatory bowel disease (IBD) (12). In this study, our objective was to investigate the correlation between vitamin D levels and NLR, PLR, and MPV, as well as to assess the association of these parameters with disease activity in patients with ankylosing spondylitis.

MATERIALS AND METHODS

Patients aged 18 years and older old and classified as AxSpA (AS and nr-AxSpA) according to ASAS classification criteria (13) who applied to the rheumatology outpatient clinic of ..... University, Faculty of Medicine, ... Hospital were incorporated in this retrospective study. Ethics committee approval was assured before commencing the investigation (Date: 11/10/2021/15).

After ethics committee approval was obtained, since the study design was retrospective, the files between May 2021 and September 2021 were scanned to evaluate the vitamin D level in the summer months, and ankylosing spondylitis patients whose vitamin D level was measured during this period were included in the study. The process extended until March 2022, as consent was obtained as the patients came to the outpatient clinic for follow-up.

Individuals diagnosed with another rheumatological disease were excluded from the study. As the control group, individuals who sought care at the same polyclinic and were matched for age and sex, with no history of chronic diseases, medication use, inflammatory conditions, or findings indicative of inflammatory diseases, were included in the study. Patients' data were obtained from the hospital database. Demographic data, vitamin D, CRP, ESR levels, Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) values, and hemogram data of the patients were retrospectively recorded. The NLR was calculated by dividing the neutrophil value by the lymphocyte value, and the PLR was determined by dividing the platelet value by the lymphocyte value. Mean platelet volume (MPV) normal reference values are 6.5-12 fL due to our laboratory systems. Cut-off values for elevated C-reactive protein (CRP) were set at >5 mg/L, for erythrocyte sedimentation rate (ESR) >15 mm/hour for males and >20 mm/hour for females, and high leukocyte levels were defined as >10 x 103/μL. Vit-D ranges >30 ng/mL were considered normal, <20 ng/mL deficiency, and 30>vit D> 20 ng/mL insufficiency. Patients with a BASDAI value ≥ 4 were categorized as active.

Serum 25-hydroxyvitamin D (25(OH)D) levels were assessed using an Advia-Centaur XP device (Siemens AG, Munich, Germany) and Vit-D kits from Siemens. Hemogram parameters were measured using the Mindray BC 6800 (Mindray, Shenzhen, P.R. China) automatic hematology analyzer.

Statistical analysis

Statistical analysis was conducted using Jamovi (version 1.2.27). The distribution of data was assessed with the one-sample Kolmogorov–Smirnov test. For nonparametric quantitative data, group differences were examined using the Mann–Whitney U test. The chi-square test was employed to analyze significant differences in qualitative variables. Correlations were assessed using the Spearman correlation coefficient. Data were presented as the median (Q1-Q3) unless otherwise specified. All p values were two-sided, and statistical significance was considered at

p<0.05.

RESULTS

The study encompassed a total of 228 participants, consisting of 112 patients (75 male, 37 female) and 116 controls (77 male, 39 female). Table I provides details on demographic, clinical, and laboratory data.

Table I. Demographic, biochemical data and comparisons

	Patients	Controls	p Values
(n)	112	116	
Gender (Female/ Male)	37/75	39/77	>0.05
Age (Years)	45 (36-51.75)	41.5 (35-49)	>0.05
25(OH)D (ng/mL)	18.42 (12.52-25.33)	14.64 (9.44-20.99)	0.003
NLR (Ratio)	2.18 (1.73-3.07)	1.94 (1.46-2.49)	0.002
PLR (Ratio)	123.94 (98.48-155.12)	106.03 (88.92-127.87)	0.002
MPV (fL)	9 (8.4-9.78)	9.5 (8.8-10.20)	0.003
CRP (mg/L)	7 (2.55-17.70)	1.8 (0.8-3.25)	<0.001
ESR (mm/hour)	14 (5-31)	9 (4-16.5)	0.001
BASDAI	5.66 (3.94-7.49)		

Values are expressed as Median (Q1-Q3). Mann-W U test. *Fisher's Exact Test

NLR: Neutrophil/Lymphocyte Ratio, PLR: Platelet/Lymphocyte Ratio, MPV: Mean Platelet Volume CRP: C-Reactive Protein, ESR: Erythrocyte Sedimentation Rate, BASDAI: Bath Ankylosing Spondylitis Disease Activity Index

A notable difference was observed between the control and patient groups regarding Vit-D, NLR, PLR, MPV, CRP, and ESR. Except for the MPV value, the measured levels were lower in the control group compared to the patient group.

In accordance with the BASDAI cut-off of 4, Vit-D showed marginal significance among patients, but no significant differences were detected in terms of NLR, PLR, CRP, and ESR values. However, MPV values were found to be significantly lower in individuals with BASDAI≥4 (refer to Table II).

Table II. Comparisons between active and inactive patients

	BASDAI<4	BASDAI≥4	p Values
(n)	30	82	
Age (year)	47 (38-53.5)	45 (36-51.25)	>0.05
25(OH)D (ng/mL)	20.17 (15.94-27.43)	16.77 (12.08-24.17)	>0.05
NLR (Ratio)	2.15 (1.96-2.78)	2.21 (1.66-3.15)	>0.05
PLR (Ratio)	125.23 (79.51-148.54)	123.94 (101.10-155.79)	>0.05
MPV (fL)	9.4 (8.68-10.43)	8.9 (8.28-9.53)	0.025
CRP (mg/L)	5.7 (2.65-13.78)	7.35 (2.48-17.73)	>0.05
ESR (mm/hour)	7.5 (5-22.845)	17 (5-40.25)	>0.05
BASDAI	3 (1.99-3.52)	6.7 (5.5-7.83)	0.000

Values are expressed as Median (Q1-Q3). Mann-W U test.

NLR: Neutrophil/Lymphocyte Ratio, PLR: Platelet/Lymphocyte Ratio, MPV: Mean Platelet Volume CRP: C-Reactive Protein, ESR: Erythrocyte Sedimentation Rate, BASDAI: Bath Ankylosing Spondylitis Disease Activity Index

In the comparison of patients based on gender, it was observed that CRP and Vit-D levels were significantly lower in females compared to males. Conversely, MPV, ESR, and BASDAI levels were significantly higher in males. However, no significant difference was found in terms of NLR and PLR (refer to Table III; P1).

The levels of CRP showed a notable increase specifically in female patients compared to both the patient and control groups among females (Table III; P3). In male patients, on the other hand, Vit-D, NLR, PLR, CRP, and ESR values were significantly elevated, while MPV values were significantly lower compared to the control group (Table III; P4).

In comparison to the control group, active patients exhibited significantly higher levels of Vit-D, NLR, PLR, CRP, and ESR, while the MPV level was significantly lower (Table IV).

Table III. Comparisons between sexes

	P-Patients		C-Controls		P-F/M	C-F/M	F-P/C	M-P/C
	F (n:37)	M (n:75)	F (n:39)	M (n:77)	P1	P2	P3	P4
25(OH)D (ng/mL)	15.78 (10.07-19.65)	19.53 (14-26.16)	13.86 (8.39-21.75)	14.74 (10.47-20.31)	0.014	>0.05	>0.05	0.001
NLR (Ratio)	2.06 (1.63-2.81)	2.21 (1.89-3.32)	2.09 (1.48-2.61)	1.82(1.43-2.44)	>0.05	>0.05	>0.05	0.001
PLR (Ratio)	124.26 (102.79-166.46)	127.27 (96.93-155.73)	122.51 (105.17-150)	101.65 (84.47-115.09)	>0.05	<0.001	>0.05	<0.001
MPV (fL)	9.5 (8.55-10.55)	8.8 (8.2-9.4)	9.5 (8.74-10.2)	9.5 (8.8-10.25)	0.008	>0.05	>0.05	<0.001
CRP (mg/L)	4.5 (1.55-10.65)	8.3 (2.8-19.8)	2.2 (1-3.1)	1.4 (0.75-3.4)	0.018	>0.05	0.005	<0.001
ESR (mm/hour)	18 (11-37)	11 (4-31)	20 (12-31)	6 (4-12.75)	0.045	<0.001	>0.05	<0.001
BASDAI	6.53 (5.29-7.75)	5.4 (3.5-7.44)	-	-	>0.05	-	-	-

P1: In Patient- Comparisons between Female and Male, P2: In Control- Comparisons between Female and Male, P3: In Female- Comparisons between Patient and Control, P4: In Male- Comparisons between Patient and Control: Patient. C: Control. F: Female. M: Male. Values are expressed as Median (Q1-Q3). Mann-W U test.

NLR: Neutrophil/Lymphocyte Ratio, PLR: Platelet/Lymphocyte Ratio, MPV: Mean Platelet Volume CRP: C-Reactive Protein, ESR: Erythrocyte Sedimentation Rate, BASDAI: Bath Ankylosing Spondylitis Disease Activity Index

Table IV. Comparisons between controls and patients with BASDAI ≥4

	Controls	BASDAI≥4	p Values
(n)	116	82	
Age (year)	41.5 (35-49)	45 (36-51.25)	>0.05
25(OH)D (ng/mL)	14.64 (9.44-20.99)	16.77 (12.08-24.17)	0.046
NLR (Ratio)	1.94 (1.46-2.49)	2.21 (1.66-3.15)	0.004
PLR(Ratio)	106.03 (88.92-127.87)	123.94 (101.10-155.78)	0.001
MPV(fL)	9.5 (8.8-10.2)	8.9 (8.275-9.53)	0.000
CRP (mg/L)	1.8 (0.8-3.25)	7.35 (2.475-17.73)	0.000
ESR (mm/hour)	9 (4-16.5)	17 (5-40.25)	0.000

Values are expressed as Median (Q1-Q3). Mann-W U test.

NLR: Neutrophil/Lymphocyte Ratio, PLR: Platelet/Lymphocyte Ratio, MPV: Mean Platelet Volume CRP: C-Reactive Protein, ESR: Erythrocyte Sedimentation Rate, BASDAI: Bath Ankylosing Spondylitis Disease Activity Index

In all patients, there was a negative correlation between CRP and ESR with MPV (r: -0.305, p < 0.001; r: -0.192, p: 0.013) and a positive correlation with NLR (r: 0.411, p < 0.001; r: 0.245, p = 0.009) and PLR (r: 0.377, p < 0.001; r: 0.397, p < 0.001), respectively. Additionally, there was a negative correlation between BASDAI and MPV (r: -0.219, p = 0.020), and no relationship was observed between Vit-D and either acute phase reactants or NLR or PLR.

DISCUSSION

Vitamin D, primarily synthesized endogenously in the skin through the influence of sunlight's ultraviolet B rays, plays a crucial role in promoting bone homeostasis, especially during the summer months. In recent years, there has been a growing recognition of the association between vitamin D insufficiency and deficiency and various chronic diseases including cardiovascular diseases, metabolic syndrome, common cancers, as well as infectious and autoimmune diseases. (14). This deficiency, which is considered a natural phenomenon in countries where the sun's rays are not sufficiently taken, is now recognized as a global epidemic due to the fact that many people avoid the sun, use extensive sunscreens, and work in offices that are not exposed to the sun throughout the day. Although the relationship between vitamin D deficiency and inflammation has been scrutinized in many studies, no consensus has yet been reached on this condition (15). It has been shown that "active vitamin D receptors" are found in immune cells, and these cells can also activate vitamin D locally. Therefore, investigation on vitamin D deficiency and its relationship with infections and autoimmune diseases is of high interest at present (16).

The effect of high vitamin D (1,25OHD) production suppresses T-cell growth by switching from Th1 to Th2 phenotype, resulting in increased production of anti-inflammatory immune markers such as IL-10 and inflammatory cytokines (TNF-α, IFN-γ, IL-17, IL-21) . Current evidence suggests that the level of circulating 25(OH)D may be critical for the optimal anti-inflammatory response of human monocytes. Low levels of vitamin D in the body can reduce the expression of anti-inflammatory cytokines that inhibit pro-inflammatory cytokines such as IL-10. This can lead to an increase in unwanted inflammation, tissue damage, and autoimmune disease (17).

Diagnosing ankylosing spondylitis does not rely on specific laboratory tests. Although ESR, CRP, and other acute phase reactants help in diagnosis and follow-up, they often do not correlate with disease activity (18). Novel methods are needed to ensure the correlation. During systemic inflammation, it is clear that there are changes in the composition and amount of circulating blood cells. Normochromic microcytic anemia, neutrophilia, lymphopenia, and thrombocytosis are associated with many inflammatory conditions. Hence, the components of the blood cells in the circulation could be used to evaluate inflammatory activity (19).

Previous studies have explored the correlation between ankylosing spondylitis (AS) activity and vitamin D levels. (20). Some studies have indicated that vitamin D levels are lower in the ankylosing spondylitis (AS) group compared to the control group (21), while other studies have reported no significant difference in vitamin D levels between the AS and control groups (22). In our study, we found 25(OH)D levels in AS patients to be significantly higher than those in the control group, as in the studies of Deng et al. and Klingberg et al. (22,23). The inconsistency may be attributed to the small number of patients, seasonal and regional variations, and vitamin D supplementation. In our study, we did not find a correlation between vitamin D data and BASDAI, CRP, and ESR, which indicate disease activity, or between NLR, PLR, and MPV, which can be an indicator of inflammation. The literature shows significant variability in the relationship between vitamin D levels and disease activity indicators. Like our findings, certain studies have not identified a correlation between vitamin D levels and BASDAI (24). However, some studies have found a strong correlation in which an increase in vitamin D levels corresponds to a reduction in markers of disease activity (25).

In some of the studies, the control group exhibited lower MPV values compared to the patient group, and there was a negative correlation between MPV and acute phase reactants in these investigations (26,27). In some cases, MPV values were observed to be lower in the patient group than in the control group. They observed reduced MPV values in patients with active inflammatory bowel disease (28). Kisacik et al. discovered that MPV values were lower in patients with active rheumatoid arthritis (RA) and ankylosing spondylitis (AS) compared to controls, and these values increased significantly after treatment (19). In our study, like to these investigations, we observed a significantly higher MPV level in the control group. No difference was observed between the control group and the group with a BASDAI of <4 (data not shown). However, a significant difference was noted between the patients with a BASDAI of ≥4, with the MPV values of the control group being significantly higher. This suggests that MPV can help us detect inflammation. In our study, we also observed a negative correlation between MPV and BASDAI, an indicator of disease activity. In situations where acute phase reactants, such as in ankylosing spondylitis (AS), may not be indicative of disease activity, examining the MPV level appears to be a cost-effective method that can aid in detecting disease activity.

Variations in the literature may be attributed to the stage of inflammation in the patient and the duration of the sample collection. It has been shown clinically that inflammatory diseases influence hematopoiesis, causing the most thrombocytosis and anemia (29). It has been suggested that elevated cytokines, particularly IL-6 levels, could influence platelet stimulation, leading to the release of a significant number of platelets from the bone marrow (30). This could elucidate the higher MPV values observed in some studies among AS patients compared to the control group, potentially due to an increase in circulating young platelets. In some studies, reduced MPV values might be attributed to the substantial consumption of platelets in the inflamed area (31). Moreover, it has been proposed that the excessive production of proinflammatory cytokines and acute phase reactants may impact the megakaryopoiesis process,

leading to the future release of small-volume platelets from the bone marrow and consequently a decrease in platelet size (32,33). Additional studies are necessary to elucidate and clarify this situation.

In our study, the NLR and PLR did not show statistically significant differences in the patient group when analyzed according to sex. Although MPV and CRP were higher in males, BASDAI was higher in females. It can be thought that this is because females feel pain due to lower vitamin D levels and that conditions such as fibromyalgia are more common in females (34). Furthermore, in the comparison between the male patient and control groups, MPV was lower, while Vit-D, NLR, and PLR levels were significantly higher in the patient group. These values were not different between the female patient and control groups. This may be due to the small number of females.

The study had several limitations. Firstly, it is important to note that this study is limited by its single-center design and a relatively small sample size. Another constraint is that the control group was chosen from individuals experiencing nonspecific joint or muscle pain rather than from a pool of healthy volunteers. Additionally, the retrospective nature of the evaluation is another notable limitation. Prospective randomized studies with well-defined control groups are likely to yield more accurate results. Moreover, the retrospective analysis limited our access to clinical data, preventing us from tracking changes in NLR, PLR, and MPV values with treatment during follow-up. It is clear that vitamin D levels are affected by seasonal changes. Although the tests were analyzed between May and September, this parameter also affected the results of our study. In conclusion, while our study identified higher serum 25(OH)D3 levels in ankylosing spondylitis patients compared to healthy controls, no significant correlation was observed between these serum levels and the severity of the disease. However, we found a significant negative correlation between serum MPV level and BASDAI, CRP, and ESR, which are indicators of disease activity. Larger prospective investigations are needed to accept the use of inexpensive and easily available MPV in disease follow-up.

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