



ORIGINAL ARTICLE

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## Analysis of mean platelet volume values in patients with tinnitus

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### Abstract

Tinnitus is a condition in which the patient feels a sound in the ear without any external stimuli causing the sound. Idiopathic subjective tinnitus is highly common in adults. Mean platelet volume (MPV) is an important laboratory marker frequently used to evaluate numerous clinical conditions. This study aimed to investigate whether MPV shows a significant difference in patients with subjective tinnitus. The retrospective study included 421 patients with subjective tinnitus and 118 healthy age- and gender-matched control subjects. MPV and platelet (PLT) counts were recorded for each participant. No significant difference was observed between tinnitus patients and healthy controls concerning MPV value. Further studies are needed to investigate unknown mechanisms related to subjective tinnitus.

**Keywords:** Tinnitus, mean platelet volume, complete blood count, platelet

### Introduction

Tinnitus is a condition in which the patient feels a sound in the ear without any external stimuli causing the sound [1]. Tinnitus is one of the most common otological symptoms [2]. Tinnitus is divided into subjective and objective, with the subjective being more common in adults [3,4].

Mean platelet volume (MPV) is an important and frequently used laboratory marker, indicating platelet (PLT) function associated with inflammation [5,6]. It is also an important marker showing the activity and function of PLTs. Large-volume PLTs are enzymatically and metabolically have a higher activity and potential thrombotic ability [6-8]. Moreover, they also tend to more aggregate than small PLTs [8].

Vascular ischemic events and platelet volume markers changes may be diagnostic in thrombotic and prothrombotic cases. MPV is increased in clinical conditions such as myocardial infarction

(MI), venous thromboembolism, and stroke, and a higher MPV has been reported as a stroke and MI risk factor [8-11]. Additionally, a higher MPV is related to damage to vascular endothelial and several other cardiovascular diseases [12-14]. On the other hand, increased MPV and vascular diseases have been associated with sudden sensorineural hearing loss (SSNHL) [15,16].

This study examined the association between subjective tinnitus and PLT size because vascular and inflammatory diseases are found relatable with MPV.

### Materials and Methods

A total of 421 patients were included in this retrospective study having subjective tinnitus who presented to the ear, nose, and throat (ENT) clinics between January 2019 and December 2020. Additionally, a control group of 118 patients who had previously undergone elective septoplasty in an ENT clinic was also included in the study. At the outset, the approval of the Clinical Research and Ethics Committee of Antalya Training and Research Hospital was obtained (Decision date: 04/03/2021, no: 1/10).

Smokers and patients with chronic inflammatory diseases, including systemic hypertension, diabetes mellitus, coronary artery disease, chronic kidney failure, pulmonary thromboembolism, chronic obstructive pulmonary disease, and chronic liver disease,

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were excluded from the study. Complete blood count (CBC) results were retrieved from medical records. MPV and PLT counts were recorded for each participant.

### Statistical analysis

SPSS for Windows version 25.0 (Armonk, NY: IBM Corp.) was used for analyzing data. Continuous variables were expressed via descriptives were expressed as mean  $\pm$  standard deviation (SD), and categorical variables were expressed as frequencies (n) and percentages (%). The normal distribution of PLT values was analyzed using the Shapiro-Wilk test. Since a normal distribution was detected, parametric tests were used in statistical analysis. A t-test was used to compare categorical variables. Three or more categorical variables were compared using One-Way ANOVA. A p-value of  $<0.05$  was considered significant.

### Results

The mean age was  $44.59 \pm 16.99$  years in the patient group and  $33.76 \pm 12.94$  years in the control group (Table 3). The patient group comprised 170 men and 251 women, and the control group comprised 66 men and 52 women (Table 3). The mean MPV value was  $9.93 \pm 1.98$  fL in the patient group as opposed to  $10.35 \pm 0.851$  fL in the control group, and no significant difference was established ( $p=0.856$ ) (Table 5).

The mean PLT count was  $269.95 \pm 73.08 \times 10^3 \mu/L$  in the patient group and  $273.50 \pm 79.08 \times 10^3 \mu/L$  in the control group, and no significant difference was established ( $p=0.784$ ) (Table 4).

As seen in (Table 2), a significant difference was observed between genders and MPV groups concerning PLT count ( $p=0.018$  and  $p=0.006$ , respectively), whereby women and patients with a normal MPV had significantly higher PLT counts compared to other patients. Nevertheless, we did not find any significant difference between the control and patient groups and among age groups concerning PLT count ( $p>0.05$  for both).

**Table 1.** Demographic and clinical characteristics

Variable	n	%
<b>Gender</b>		
Male	236	43.8
Female	303	56.2
<b>MPV value</b>		
Normal	527	97.8
High	12	2.2
<b>Group</b>		
Tinnitus	420	78.1
Control	118	21.9
<b>Age (years)</b>		
$\leq 30$	89	16.5
31-50	176	32.7
51-60	128	23.7
$61 \leq$	146	27.1
	<b>Mean</b>	<b>SD</b>
<b>Age (years)</b>	49.59	17.01

MPV: Mean platelet volume, SD: Standard deviation

**Table 2.** Comparison of PLT values according to demographic and clinical characteristics

Variable	n	Mean	SD		
<b>Gender</b>					
Male	236	261.23	75.65	-2.378	0.018
Female	303	275.76	66.01		
<b>MPV value</b>					
Normal	527	270.65	70.63	2.741	0.006
High	12	214.42	50.53		
<b>Group</b>					
Tinnitus	420	267.89	67.79	-0.765	0.444
Control	118	273.51	79.42		
<b>Age (years)</b>					
$\leq 30$	89	265.89	64.58		
31-50	176	268.15	72.99	0.222	0.881
51-60	128	273.33	67.45		
$61 \leq$	146	269.59	74.67		

PLT: Platelet, MPV: Mean platelet volume, SD: Standard deviation

**Table 3.** Age and gender distribution

	Study group	Control group
<b>Age (years)</b>	$44.59 \pm 16.99$	$33.76 \pm 12.94$
<b>Gender</b>		
Female	170 (32%)	66 (55%)
Male	251 (58%)	52 (45%)

**Table 4.** Mean PLT values

	Study group	Control group	p
<b>Platelet (<math>10^3 \mu/L</math>)</b>	269.950	273.500	0.784
	(137.000–535.000)	(135.000–508.000)	

PLT: Platelet

**Table 5.** Mean MPV values

	Study group	Control group	p
<b>MPV (fL)</b>	$9.93 \pm 1.09$	$10.35 \pm 0.85$	0.856

MPV: Mean platelet volume

### Discussion

Tinnitus is a heterogeneous condition with an unclear etiology, considered to be caused by ischemia and inflammation, exposure to high-level noise, or damage to the hearing system [12]. Additionally, Ozbay et al. reported that stress may cause inflammation, thereby resulting in tinnitus [13]. MPV is an important PLT index indicating the activity and function of PLT,

which can be easily measured in routine CBC. Moreover, MPV is responsible for the pathogenesis of some cardiovascular diseases and is associated with the prognosis of these disorders [14-16]. Also, Ulu et al. and Sagit et al. suggested that increased MPV and vascular diseases may be associated with SSNHL [17,18]. Nonetheless, Karli et al. and Bláha et al. reported no significant relationship between increased MPV and SSNHL [6,19].

Ozbay et al. found an increased neutrophil-to-lymphocyte ratio (NLR) in patients with tinnitus compared to control subjects, while no significant difference was found regarding MPV [13]. Moreover, Kemal et al., for the first time in the literature, found higher MPV values in patients with tinnitus compared to control subjects [20].

Sarikaya et al., for the first time in the literature, found higher MPV values in patients with subjective tinnitus than in control subjects [3]. However, Beyan et al. criticized this study and argued that MPV values could not be elevated in subjective tinnitus patients since there were no standardized blood collection and measurement techniques [21]. In contrast, Yuksel et al. reported lower MPV levels for subjective tinnitus patients than control subjects and suggested that MPV could be a useful indicator in evaluating patients with subjective tinnitus [11]. On the other hand, Bayram et al. found no significant difference between patients with subjective tinnitus and healthy controls concerning mean NLR, platelet-to-lymphocyte ratio (PLR), and MPV values [22]. Similarly, Arli et al. found no significant difference between patients with subjective tinnitus and healthy controls concerning MPV and PLT values [23].

## Conclusion

Tinnitus is a common clinical condition with a multifactorial etiology. Studies conducted on patients with tinnitus have reported different results such as increased, decreased, and similar MPV values compared to healthy individuals. The present study found no significant difference between tinnitus patients and healthy controls concerning MPV values. Based on these findings, we consider that MPV values alone may not be significant in the pathogenesis of tinnitus and may not be helpful in the clinical evaluation of tinnitus patients. More studies are required to elucidate the unknown aspects of this clinical condition with a multifactorial etiology.

## Conflict of interests

*The authors declare that there is no conflict of interest in the study.*

## Financial Disclosure

*The authors declare that they have received no financial support for the study.*

## Ethical approval

*At the outset, the approval of the Clinical Research and Ethics Committee of Antalya Training and Research Hospital was obtained (Decision date: 04/03/2021, no: 1/10).*

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