Scientific Foundation SPIROSKI, Skopje, Republic of Macedonia
Open Access Macedonian Journal of Medical Sciences. 2023 Jan 24; 11(B):309-313.
https://doi.org/10.3889/oamjms.2023.11308
eISSN: 1857-9655
Category: *B - Clinical Sciences*
Section: *Endocrinology*

The Relation between Mean Platelets Volume and Obesity among patients in the Primary Health-care Centers at National Guard in Jeddah, Saudi Arabia

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Edited by: Ksenija Bogoeva-Kostovska
Citation: Alzahrani A, Alshehri Y, Alageel N, Bakraa R, Rawas R, Alwagdani R. The Relation between Mean Platelets Volume and Obesity among patients in the Primary Healthcare Centers at National Guard in Jeddah, Saudi Arabia. Open Access Maced J Med Sci. 2023 Jan 24; 11(B):309-313. https://doi.org/10.3889/oamjms.2023.11308
Keywords: Mean platelets volume; Body mass index; Obesity
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Received: 02-Nov-2022
Revised: 12-Dec-2022
Accepted:14-Jan-2023

Funding: This research did not receive any financial support
Competing Interests: The authors have declared that no competing interests exist

Abstract

BACKGROUND: Obesity is excess and fat accumulation that lead to negative effects on health. Many studies found an association between obesity and MPV. MPV is a determinant of platelet function, since platelet size has been proven to reflect platelet activity, which is an useful predictive biomarker for a variety of diseases. This is the second study in which MPV was evaluated in obese patients in KSA.

AIM: The aim of study is to evaluate the relation between MPV and obese patients without metabolic risk factors at NGHA Jeddah, KSA. Secondary objectives are to compare between genders and to evaluate the association between total platelets count and obesity.

METHODS: This was a cross-sectional study, A. Inclusion criteria: For the first group, any patient with BMI ≥ than 30 kg/m^2 aged 18 years or more. Second group, non-obese aged 18 years or more. Exclusion criteria: Metabolic risk.

RESULTS: There were 279 participated in this study. Most of the participants 214 (72.1%) were females, and 83 (27.9%) were males (Table 1). The mean age was 33.39 ± 10.19. There were 148 (49.8%) participants with normal BMI level, and 149 (50.2%) considered as obese. For MPV classification, 287 (96.6%) were normal, and 10 (3.4%) were high. In this case–control study, we found no significant evidence relating the association between MPV and obesity.

CONCLUSION: In this study, we found no significant difference between MPV and platelet count between them. However, there was a significant positive week correlation between BMI and age with p = 0.0001.

Introduction

Obesity is defined as having excess and abnormal fat accumulation that can lead to negative effects on health. People are considered obese if their body mass index (BMI) is above 30 kg/m^2. According to the WHO, the worldwide prevalence of obesity almost tripled between 1975 and 2016. About 13% of the world's adult population (11% of men and 15% of women) were obese in 2016 [1]. In the Kingdom of Saudi Arabia (KSA), the prevalence of obesity among adults increased from 22% in 1990–1993 to 36% in 2005. Furthermore, the overall obesity will increase to 41% in men and 78% in women by 2022 [2], [3], [4]. Obesity is considered an issue because it is associated with many complications that can happen in the body. Obesity is a risk factor for many chronic diseases such as cardiovascular diseases, DM, and some types of cancer. As a result, it has been found that obesity reduces life expectancy. According to the WHO, at least 2.8 million, people dying each year as a result of being overweight or obese [1]. Therefore, finding a simple marker to identify people who are obese and prone to develop complications will help in the reducing morbidity and mortality. One of the major complications of obesity is ischemic heart disease (IHD). The process of platelets activation and aggregation plays an important role in the pathophysiology of IHD. The activation of platelets leads to increased platelet volume and more platelet adhesions happen which end up by developing a thrombus. As a result, heart diseases and almost all its risk factors such as obesity, HTN, hypercholesterolemia, DM, and smoking might be measured by using platelet markers such as mean platelets volume (MPV). MPV is a determinant of platelet function, since platelet size has been proven to reflect platelet activity, which is an useful predictive biomarker for a variety of pro-thrombotic and pro-inflammatory diseases including cardiovascular events [5], [6]. Therefore, we choose MPV mainly to find if there is a significant association with obesity. Many studies around the world found an association between obesity and MPV. One of these studies shows that MPV is increased in middle-age obese patients, without the presence of other cardiovascular, hematological, and

renal diseases risk factors [7]. Another study, that was done in Poland, found a weak but statistically significant correlation between the MPV value, waist circumference, and the BMI [8]. Moreover, a study was done in Turkey showed that MPV could be considered as a marker of inflammatory burden in obese patients [9]. Furthermore, another study in Turkey found that obese group had significantly higher MPV level than in non-obese control group and concluded by founding a positive correlation between BMI and MPV [10]. An interventional study carried out between two groups normal weight subjects and overweight/obese subjects, showed MPV values directly proportional to BMI [11]. Another study demonstrated that the percent body fat is one of the parameters independently associated with MPV in the elderly population [11]. According to our knowledge and while analyzing the literatures, this is the second study in which MPV was evaluated in obese patients in KSA. The first study was done in Najran area and concluded that there was no significant difference was observed in MPV between obese patients and non-obese control group [12]. Therefore, to increase public data available regarding this topic in KSA, the aim of this study is to evaluate the relation between MPV and obese patients without metabolic risk factors at National Guard Hospital Affairs-Jeddah. It is of a particular importance to gather our own local data to provide a profound understanding of our public health status and a ground for comparison with data from different ethnicities and geographical location.

Methodology

Design

This was a cross-sectional study.

Study population

Patients at National Guard Hospital Affairs-Jeddah.

Inclusion criteria

The following criteria were included in the study:

1. Any patient with BMI equal or more than 30 kg/m^2 aged 18 years old or more (first group).
2. Healthy non-obese subjects aged 18 years old or more (second group).

Exclusion criteria: (for both two groups)

The following criteria were excluded from the study:

1. Who has smoking habit
2. DM
3. Sustained HTN
4. Taking any antiplatelet agents
5. Cancer patients
6. Heart disease
7. Subjects with incomplete data.

Sample size was calculating using the following formula: $N= (Za)^2 [p*q]/d^2$

p: The prevalence of the condition, q: (1-p), d: The precision of the estimate (Margin of error) and Z [Z alpha]: The value of z from the probability tables. If the values are normally distributed, then 95% of the values will fall within two standard errors of the mean. The value of z corresponding to this is 1.96 (from the standard normal variant tables). Based on similar studies (8) and margin of error of 5%, so the minimum representative sample is 300.

Data collection

The data collected after obtaining the institutional review board (IRB) approval. Blood samples drawn from subjects after a fasting period of 12 h. We measured MPV in a blood sample collected in citrate (1: 4 v/v) to avoid the platelet swelling induced by EDTA. The expected values for MPV in our laboratory ranged from 7.0 to 11.0 fl. Results showed in BestCare system, and gathered in a sheet. Completed data entered into an Excel sheet in a secured computer. Data reviewed and cleaned before analysis.

Statistical analysis

Data were analyzed using the SPSS for Windows (release 22.0; SPSS Inc. Chicago, IL, USA). All data expressed as the mean ± SD. Differences between the study group analyzed using Student's t-test. Quantitative data analyzed by 2-test. Pearson correlation analysis and Spearman's rho correlation analysis were used to evaluate the correlation of variables. The variables significant in univariate analysis included in multivariate logistic regression analysis. $p < 0.05$ is considered to be statistically significant.

Results

There were 279 participants participated in this study at National Guard Hospital Affairs-Jeddah, Saudi Arabia. Most of the participants 214 (72.1%) were females, and 83 (27.9%) were males (Table 1). The mean age was 33.39 ± 10.19. The minimum age was 18 and the maximum age was 69 years old. The mean weight was 82.04 ± 29.25 and the mean height was

153.89 ± 24.31. The mean BMI level was 29.17 ± 6.57 and the mean MPV level was 8.60 ± 1.19 (Table 2). There were 148 (49.8%) participants with normal BMI level, and 149 (50.2%) considered as obese. For MPV classification, 287 (96.6%) were normal, and 10 (3.4%) were high.

Table 1: Mean platelets volume difference between healthy nonobese patients and obese patients

Parameter	BMI, mean ± SD		Mean difference	Mean difference (95% CI)	T	p
	Health	Obese				
MPV	8.54 ± 1.15	8.66 ± 1.24	−0.12	−3.89–0.16)	−0.83	0.41*

Normality assumption is fulfilled based on CLT. Independent simple t-test was applied. *Significant at the level 0.05. BMI: Body mass index, SD: Standard deviation, CI: Confidence interval, MPV: Mean platelets volume.

The first objective of this study was to determine the difference of MPV between healthy non-obese patients and obese patients. An independent sample t-test was used.

Table 2: Demographic analysis of the study

Variables	Frequency (%)
Gender	
Male	83 (27.9)
Female	214 (72.1)
BMI classification	
Normal	148 (49.8)
Obese	149 (50.2)
MPV classification	
Normal	287 (96.6)
High	10 (3.4)

Table 3 shows the MPV differences between health participants and obese patients. It is shown in Table 3 that there is no statically significant difference between health and obese patients in their MPV values with p = 0.41 (Table 3).

Table 3: Association between body mass index and gender

Gender	BMI		χ^2	p
	Normal	Obese		
Male	44 (14.8)	39 (13.1)	0.466	0.495
Female	104 (35)	110 (37)		

BMI: Body mass index.

The second objective of the study was to find the association between gender, BMI, and MPV. Chi-square was used for this objective with Spearman correlation. As presented in Tables 4 and 5, there is no association between BMI and gender. Therefore, the null hypothesis is supported (Tables 4 and 5).

Table 4: Association between mean platelets volume and gender

Gender	MPV		χ^2	p
	Normal	High		
Male	80 (26.9)	3 (1)	-	1.00
Female	207 (69.7)	7 (2.4)		

MPV: Mean platelets volume.

In Table 4, the Fisher's exact test statistic value is 1. The result is not significant as p = 1. Therefore, there is no statically significant association between MPV and gender (Table 4).

Correlation between MPV and BMI with age

As shown in Table 5, there is significant positive very week correlation between BMI and age (r = 0.227, p = 0.001). That was supported by Spearman's rho test (r = 0.261, p = 0.001). That means whenever age increases BMI will increase too. On the other hand, there was no significant correlation between MPV and age in Spearman's rho and Pearson correlation (Table 5).

Table 5: Spearman's rho and pearson correlation in age with mean platelets volume and body mass index

Test	Variable	*R*	p
Age			
Spearman's rho	MPV	0.008	0.893
	BMI	0.261	0.001
Pearson correlation	MPV	−0.007	0.909
	BMI	0.227	0.001

MPV: Mean platelets volume, BMI: Body mass index.

Association between total platelets count and obesity

The third objective of the study was to evaluate the association between total platelets' count and obesity.

The Fisher's exact test statistic value is 1. The result is not significant as p = 1. Therefore, there is no statically significant association between platelets and BMI.

Discussion

To the best of our knowledge, this is the second study in Saudi Arabia to evaluate the relation between MPV and obesity among patients. In this selected population, we have found no statistically significant difference between the obese group and control group in their MPV values and platelet counts. These results support the first study done in the Najran area and concluded that there was no significant difference observed in MPV between obese patients and the non-obese control group [12]. Whereas, a study from Turkey with a population of 100 obese and 100 non-obese subjects showed that MPV in the obese subject is higher [7]. In addition, a meta-analysis of 13 studies reported an increased MPV in individuals with obesity compared to non-obese individuals [13]. Furthermore, we found no statistically significant association between higher BMI and MPV in both genders. In comparison, the meta-analysis of the 13 studies reported an increase in the MPV was inversely associated with the BMI [13]. Another important finding was found in our study is that there was a significant positive very week correlation between BMI and age (r = 0.227, p = 0.001). The difference between this study and the other studies could be due exclusion of all patients with metabolic risk factors and chronic diseases which could affect MPV values.

Limitations of the study

The limitations of this study are the exclusion criteria of patients with clinically overt cardiovascular

disease (such as those who has a smoking habit, DM, Sustained HTN, taking any antiplatelet agents, Cancer patients, heart disease, and subjects with incomplete data.) to clarify the specific levels of BMI related abnormalities. Therefore, our results cannot be applied to all obese subjects. Another limitation is that the small sample size, which gives the study low statistical power of the analyses. Another limitation is that the results have been collected from National Guard Hospital Affairs - Jeddah only, so they may not apply to the whole of Saudi Arabia. As in the future, it will be helpful to study different regions in Saudi Arabia.

Conclusion Recommendations

In this study, we found no statistically significant difference between MPV and platelet count between obese and healthy non-obese patients. These results could be because of the small sample size; accordingly, multi-centers studies are needed. However, there was a significant positive very week correlation between BMI and age with p = 0.0001. Therefore, no modification to the local clinical practice is recommended.

Authors' Contributions

All authors revised the manuscript critically and gave final approval to submission of the manuscript. Abdullah Alzahrani: Conceptualization, Supervision, and Validation. Yasmeen Alshehri, Nourah Alageel, Roaa Bakraa, Ranad Rawas, andRaghad Alwagdani: Data curation and Writing – Original draft preparation.

Acknowledgment

We thank the participants who were all contributed samples to the study.

Informed Consent

Written and oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

Ethical Approval

The study was approved by King Abdullah International Medical Research Center (KAIMC) issued approval NRJ21J/143/05.

Data and Materials Availability

All data associated with this study are present in the paper.

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