WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.074
Volume 7, Issue 15, 942-952. Research Article ISSN 2277– 7105

PLATELET INDICES AMONG PATIENTS WITH DIABETIC MELLITUS TYPE 1 AND HYPERTENSION IN KHARTOUM STATE

Hussam MA Ibrahim[1]*, Mohanad Altayeb[1], Ammar B. Omer[2], Hind Omar[1], Shima Abu Obaida[1], Rowaida El-Zubair[1], Du'aa Abdul Rahman[1] and Umar Babangida[1]

[1]International University of Africa, Faculty of Medical Laboratory Sciences Department of Haematology and Immunohaematology, Khartoum-Sudan.

[2]International University of Africa, Faculty of Medical Laboratory Sciences Department of Histopathology and Cytology, Khartoum-Sudan.

Article Received on
15 June 2018,

Revised on 05 July 2018,
Accepted on 25 July 2018

DOI: 10.20959/wjpr201815-13039

***Corresponding Author**
Dr. Hussam MA Ibrahim
International University of Africa, Faculty of Medical Laboratory Sciences Department of Haematology and Immunohaematology, Khartoum-Sudan.

ABSTRACT

Diabetes and hypertension remains as the most imminent disease contributing to the cardiovascular disease burden due to ongoing low grade inflammation. This study was aimed to determine platelet count and platelet indices in diabetic type 1 patient, diabetic type 1 with hypertension and hypertensive patient compared with normal individual to see if there are differences in platelet count and platelet indices among them. In this study venous blood samples were collected from healthy control adult (n=30), diabetes type 1 patients (n=30), hypertensive patients (n=30), diabetes type 1with hypertension patients (n=29) into EDTA anticoagulant tubes (randomly selected). Complete blood counts for all samples were analyzed by using the Sysmex haematological analyzer, a three-part auto analyzer able to run 19 parameters per sample including platelet indices (MPV, PDW, and P-LCR). This study revealed significant difference(p value < 0.05) only in mean age of HT (55.73±10.49) and platelet count in IDDM (although its within the lower limit of normal reference range) (172.8±133.6). However, all other parameters were found to be insignificant (p value > 0.05) for all study population (IDDM, HT, and IDDM/HT).

KEYWORDS: Platelet indces, Diabetes mellitus, Hypertension.

1. INTRODUCTION

Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. Depending upon the etiology of DM, factors contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization, and increased glucose production. The metabolic deregulation associated with DM causes secondary pathophysiologic changes in multiple organ systems that impose a tremendous burden on the individual with DM and on the health care system [Longo DL 2012].

Systemic arterial hypertension (HT) is a common health disorder with uncertain etiology and pathophysiology. It affects 20%-30% of the adult population and it can lead to severe end-organ damage and clinical manifestation, including coronary heart disease and stroke, which constitute the leading cause of mortality in the general population [Kaplan NM. 2005]. Beside genetic predisposition, several mechanisms were proposed to clarify the pathophysiology of essential HT [Harrison DG. 2013]. Vascular reactivity and endothelial dysfunction, which result in increased peripheral vascular resistance, is one of the major hypotheses in the pathogenesis. Recently, it has become evident that the immune system and chronic inflammatory status may play a role in the pathogenesis of HT [Bolivar jj 2013]. Many inflammatory markers, such as high sensitive c-reactive protein (hsCRP), cytokines, andadhesion molecules have been found elevated in HT, supporting the role of inflammation [Bolivar JJ 2013-Tousis D 2014]. Hematological indices, particularly red cell distribution width (RDW), neutrophil lymphocyte ratio (NLR) and mean platelet volume (MPV), were established as markers of systemic inflammation and vascular pathology [Karabulut A 2012-He J 2014]. Their prognostic value was clearly demonstrated in coronary artery disease, stroke and several other vascular diseases. Correlation of such hematological indices and HT was also investigated and it was proposed that hematological indices may predict the severity of HT and end-organ damage [Fornal M 2014-Elbasan Z 2013].

Diabetes and hypertension remains as the most imminent disease contributing to the cardiovascular disease burden due to ongoing low grade inflammation [Garcia C 2010-Tsioufis C 2007]. While the scientific search expands to introduce and incorporate newer diagnostic and therapeutic targets to address these disease processes, it remains vital to identify the key pathological culprits in the disease pathogenesis [Lobbes MB 2010]. Traditionally the measurement of blood glucose and other markers of glycaemia provide some insight about the dis-

ease presence, but still the end stage or the underlying direct mechanics involving the accelerated process of atherosclerosis are needed to be explored [Buch MH 2010].

2. MATERIALS AND METHODS

In this study venous blood samples were collected from healthy control adult (n=30), diabetes type 1 patients (n=30), hypertensive patients (n=30), diabetes type 1with hypertension patients (n=29) into EDTA anticoagulant tubes (randomly selected). Complete blood counts for all samples were analyzed by using the Sysmex haematological analyzer, a three-part auto analyzer able to run 19 parameters per sample including platelet indices (MPV, PDW, and P-LCR).

3. RESULT

3.1 Healthy control

A total of 30 healthy adult Sudanese individuals were selected randomly during the study period. Among them 15 (50%) were males and 15 (50%) were females (Table 3.1). Their ages range from 18 to 80 years with a mean of 47years (figure 3.1). The frequency of 14 (46.7%) were less than 47 or equal to 30 years, while frequency of 16 (53.3%) their ages were more than 47 years. (Table 3.2) (Figure 3.3).

3.2 Diabetes mellitus type 1

A total of 30 Sudanese Diabetes mellitus type 1 were selected. Among them 15 (50%) were males and 15 (50%) were females (Table 3.1). Their ages range from 18 to 80years with a mean of 52years (Figure 3.1). The frequency of 13 (43.3%) were less than 47 or equal to 30 years, while frequency of 17 (56.7%) their ages were more than 47 years. (Table 3.2) (Figure 3.3).

Table 3.1: Distribution of study population according to gender.

Gender	Control		Diabetes type 1		Hypertension		Diabetes type1 with Hypertension	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Male	15	50	15	50	15	50	14	48.3
Female	15	50	15	50	15	50	15	51.7
Total	30	100%	30	100%	30	100%	29	100%

3.2.1 Comparison of diabetes mellitus type 1 patients with healthy controls

3.2.1.1 Age, platelet count, MPV, PDW, and PLC-R

No significant difference (<0.05) were obtained when the mean age of diabetes type 1 patient (52.37±9.07) were compared with those of healthy control (47.73±6.50) (Table 3.3). Moreover there were significant decrease (< 0.05) when the mean platelet count of diabetes type 1 patient (172.8±133.6) were compare with those of healthy controls (282±70.5) however, it's within thelower limit of normal reference range (Table 3.3) (Figure 3.2). Insignificant difference (<0.05) were obtained when the mean MPV of diabetes type 1 patient (9.6±0.87) were compared with those of healthy control (9.7±0.75) (Table 3.3). This study found insignificant difference (<0.05) when the mean PDW of diabetes type 1 patient (12.1±1.72) were compared with those of healthy control (11.88±1.3) (Table 3.3). The differences were not significant (<0.05) when the mean PLC-R of diabetes type 1 patient (23.56±7.88) were compared with those of healthy controls (23.3±5.6) (Table 3.3).

Table 3.3: Comparison of mean and SD between control and Diabetes type 1 according to age, platelet count, MPV, PDW, and PLC-R.

parameters	Control mean± *SD*	Diabetes type 1 mean± SD	P value
Age	47.73±6.50	52.37±9.07	0.060
Platelet count	282±70.5	172.8±133.6	0.000
MPV	9.7±0.75	9.6±0.87	0.593
PDW	11.88±1.3	12.1±1.72	0.614
PLC-R	23.3±5.6	23.56±7.88	0.920

3.3 Hypertensive patients

A total of 30 Sudanese hypertension patients were selected. Among them 15 (50%) were males and 15 (50%) were females (Table 3.1). Their ages range from 18 to 80 years with a mean of 55years (Figure 3.1). The frequency of 22 (73.3%) were less than 47 or equal to 30 years, while frequency of 8 (26.7%) their ages were more than 47 years. (Table 3.2) (Figure 3.3).

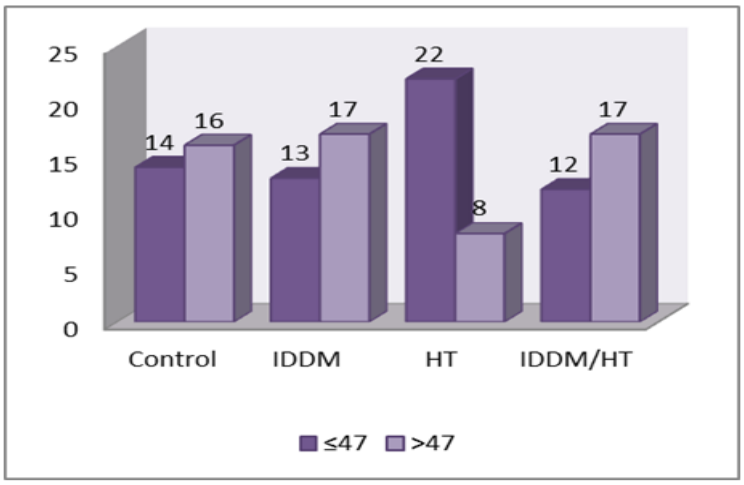

Figure 3.3: Comparison of hypertensive patients with health controls.

3.3.1 Age, platelet count, MPV, PDW, and PLC-R

Significant difference (<0.05) were obtained when the mean age of Hypertension patient (55.73±10.49) were compared with those of healthy controls (47.73±6.50) (Table 3.4) (Figure 3.2). No significant difference (< 0.05) were found when the mean platelet count of Hypertension patient (301.3±123.69) were compare with those of healthy controls (282±70.5) (Table 3.4). Also there were no significant difference (<0.05) obtained when the mean MPV of Hypertension patient (9.88±1.48) were compared with those of healthy control (9.7±0.75) (Table 3.4). This study obtained no significant difference (<0.05) when the mean PDW of Hypertension patient (12.75±3.56) were compared with those of healthy control (11.88±1.3) (Table 3.4). The differences were not significant (<0.05) when the mean PLC-R of Hypertension patient (25.16±11.28) were compared with those of healthy controls (23.3±5.6) (Table 3.4).

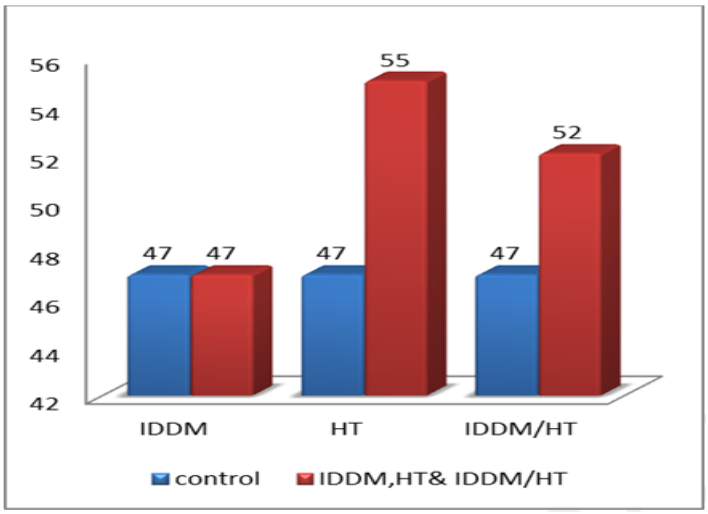

Figure 3.4: Comparison between mean age of controls with IDDM, HT, and IDDM/HT.

Table 3.4: Comparison of mean and SD between control and Hypertension according to age, platelet count, MPV, PDW, and PLC-R.

parameters	Control mean± *SD*	Hypertension *mean* ± SD	P value
Age	47.73±6.50	55.73±10.49	0.001
Platelet count	282±70.5	301.3±123.69	0.513
MPV	9.7±0.75	9.88±1.48	0.609
PDW	11.88±1.3	12.75±3.56	0.156
PLC-R	23.3±5.6	25.16±11.28	0.422

4.1 DISCUSSIONS

Diabetes and hypertension remains as the most imminent disease contributing to the cardio-vascular disease burden due to ongoing low grade inflammation Garcia C, et al, 2010 and Tsioufis, et al, C2007. While the scientific search expands to introduce and incorporate newer diagnostic and therapeutic targets to address these disease processes, it remains vital to identify the key pathological culprits in the disease pathogenesis Lobbes, et al, 2010. Traditionally the measurement of blood glucose and other markers of glycaemia provide some insight about the disease presence, but still the end stage or the underlying direct mechanics involving the accelerated process of atherosclerosis are needed to be explored Buch MH, et al, 2010.

This study was aimed to determine platelet count and platelet indices in diabetic type 1 patients, diabetic type 1 with hypertension and hypertensive patient compared with normal individual to see if there are differences in platelet count and platelet indices among them.

This study found a significant difference in mean age between hypertension compared to control (p value < 0.05) as Kannel et al, 2000, and Speizer F.E., et al, 1998, found the same results. Insignificant difference were obtained in MPV between hypertension compared to control(p value > 0.05) Nadar et al, 2004, found opposite results. Also we found significant decrease in PLT-count between IDDM patients compared to control (p value < 0.05), although its within the lower limit of normal reference range. No significant difference were found in PDW, MPV, and P-LCR between IDDM patientscompared to control (p value > 0.05), but Jabeen *et al, 2013,* found contrary results. This study detected insignificant difference in mean age between IDDM patients, IDDM with hypertension compared to control (p value > 0.05). Also the differencewere not significant in PLT-count, PDW, MPV, and P-LCR between IDDM with hypertension patients compared to control (p value > 0.05).

4.2 CONCLUSION

This study obtained insignificant difference in mean age between IDDM patients, IDDM with hypertension compared to control and significant difference in age between hypertensive patients compared to control. This shows that there is statistical significant correlation between the age and hypertension. Insignificant differences were detected in PLT-count, PDW, MPV, and P-LCR between patients with hypertension, IDDM with hypertension compared to control. Significant decrease in PLT-count were obtained between IDDM patients compared to control, however, its within the lower limit of normal reference range. This shows that there is statisticalsignificant difference between PLT-count and diabetes mellitus type 1 disease. This clearly shows that platelet reactivity alone and age cannot explain the progression of vascular complications in IDDM and hypertension since there are other vascular risk factors that may be influenced by the severity of the diseases.

REFERENCES

1. Ahmed AM, Ahmed NH. Hospitalization patternsof diabetic patients in Sudan. *Diabetes Int*., 2000; 10: 18–19.
2. American Diabetes Association(2001). Diabetes 2001 Vital statistics.
3. Alexandra, VA: ADA.
4. Bolívar JJ. Essential hypertension: an approach to its etiology and neurogenic pathophysiology. Int J Hypertens, 2013; 2013: 547809 [PMID: 24386559 DOI: 10.1155/2013/547809]
5. Buch MH, Prendergast BD, Storey RF. Antiplatelet therapy and vascular disease: an update. Ther Adv Cardiovasc Dis., 2010; 4: 249-75.
6. Biasucci LM, Leo M, De Maria GL. Local and systemic mechanisms of plaque rupture. Angiology, 2008; 59: 73-6.
7. Boos CJ, Beevers GD, Lip GYH. Assessment of platelet activationindices using the ADVIATM 120 amongst “high-risk” patients with hypertension. *Ann Med,* 2007; 39: 72-78 [PMID: 17364453 DOI:10.1080/07853890601040063]
8. Bray GA. Risks of obesity. Endocrinol Metab Clin N Am, 2003; 32: 787-804.
9. Carretero OA, Oparil S. Essential hypertension. Part I: definition andetiology. Circulation, 2000; 101(3): 329-335.
10. De Luca G, Santagostino M, Secco GG, Cassetti E, Giuliani L, Franchi E, et al. Mean platelet volume and the extent of coronary artery disease: results from a large prospective study. Atherosclerosis, 2009; 206: 292-7.

11. De Caterina R, Massaro M, Scoditti E, Annunziata Carluccio M. Pharmacological modulation of vascular inflammation in atherothrombosis. Ann N Y Acad Sci., 2010; 1207: 23-31.
12. EURODIAB ACE Study Group. Variation and trends in incidence of childhood diabetes in Europe, Lancet., 2000; 335: 873-876.
13. Erdogan D, Icli A, Aksoy F, Akcay S, Ozaydin M, Ersoy I, VarolE, Dogan A. Relationships of different blood pressure categoriesto indices of inflammation and platelet activity in sustainedhypertensive patients with uncontrolled office blood pressure. *Chronobiol Int.*, 2013; 30: 973-980 [PMID: 23834704 DOI: 10.3109/07420528.2013.790045]
14. Elbasan Z, Gür M, Sahin DY, Tanboğa IH, Cayli M. Mean platelet volume and abnormal left ventricle geometric patterns in patients with untreated essential hypertension. Platelets, 2013; 24: 521-527 [PMID: 23216609 DOI: 10.3109/09537104.2012.738839]
15. Fornal M, Wizner B, Cwynar M, Królczyk J, Kwater A, Korbut RA, Grodzicki T. Association of red blood cell distribution width, inflammation markers and morphological as well as rheological erythrocyte parameters with target organ damage in hypertension. Clin Hemorheol Microcirc, 2014; 56: 325-335 [PMID: 23719424 DOI: 10.3233/CH-131745]
16. Garcia C, Feve B, Ferré P, Halimi S, Baizri H, Bordier L, et al. Diabetes and inflammation: fundamental aspects and clinical implications. Diabetes Metab, 2010; 36: 327-38.
17. González J, Valls N, Brito R, Rodrigo R. Essential hypertensionand oxidative stress: New insights. *World J Cardiol*, 2014; 6: 353-366 [PMID: 24976907 DOI: 10.4330/wjc.v6.i6.353]
18. Guyton AC, Hall JE (2006). Textbook of Medical physiology. 11th Edition. Elsevier Inc, New Delhi.
19. Guven A, Caliskan M, Ciftci O, Barutcu I. Increased plateletactivation and inflammatory response in patients with maskedhypertension. *Blood Coagul Fibrinolysis*, 2013; 24: 170-174 [PMID:23358199 DOI: 10.1097/MBC.0b013e32835aba36]
20. Gunebakmaz O, Kaya MG, Duran M, Akpek M, Elcik D, EryolNK. Red blood cell distribution width in 'non-dippers' versus'dippers'. *Cardiology*, 2012; 123: 154-159 [PMID: 23128599 DOI:10.1159/000342667]
21. Guerrero JA, Rivera J, Quiroga T, Martinez-Perez A, Antón AI, Martínez C, et al. Novel loci involved in platelet function and platelet count identified by a genome-wide study performed in children. Hematological, 2011; 96: 1335-43.
22. Holt G. I. Diagnosis, epidemiology and pathogenesis of diabetes mellitus an update for Psychiatrists. Br. J. Psychiatry., 2004; 184: s55- s63.

23. Harrison DG. The mosaic theory revisited: common molecular mechanisms coordinating diverse organ and cellular events in hypertension. J Am Soc Hypertens, 2013; 7: 68-74 [PMID: 23321405 DOI: 10.1016/j.jash.2012.11.007]
24. He J, Li J, Wang Y, Hao P, Hua Q. Neutrophil-to-lymphocyte ratio (NLR) predicts mortality and adverse-outcomes after ST-segment elevation myocardial infarction in Chinese people. Int J Clin Exp Pathol, 2014; 7: 4045-4056 [PMID: 25120783]
25. Kaplan NM. Systemic hypertension: mechanism and diagnosis. In: Zipes DP, Libby P, Bonow RO, Braunwald E, editors. Braunwald's heart disease. Philadelphia: Elsevier Saunders, 2005: 959-987.
26. Karabulut A, Uzunlar B. Correlation between red cell distribution width and coronary ectasia in the acute myocardial infarction. Clin Appl Thromb Hemost, 2012; 18: 551-552 [PMID: 22962309 DOI: 10.1177/1076029611436198]
27. Kucharska-Newton AM, Monda KL, Campbell S, Bradshaw PT, Wagenknecht LE, Boerwinkle E, et al. Association of the platelet GPIIb/IIIapolymorphism with atherosclerotic plaque morphology The Atherosclerosis Risk in Communities (ARIC) Study. Atherosclerosis, 2011; 216: 151-6.
28. Kaplan NM. Systemic hyertension: mechanism and diagnosis. In: Zipes DP, Libby P, Bonow RO, Braunwald E, editors. Braunwald'sheart disease. Philadelphia: Elsevier Saunders, 2005: 959-987.
29. Kyrou I, Chrousos GP, Tsigos C. Stress, visceral obesity, and metaboliccomplications. Ann NY Acad Sci., 2006; 1083: 77-110.
30. Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, HeJ. Global burden of hypertension: analysis of worldwide data. Lancet, 2005; 365(9455): 217-223.
31. Ken Kaito, Hiroko Otsubo, Noriko Usui, Miyuki Yoshida, Jyunko Tanno, Etsuko Kurihara, Kozue Matsumoto, Ryuzo Hirata, Kenichi Domitsu and Masayuki Kobayashi.(2005), Platelet size deviation width, platelet large cell ratio, and mean platelet volume have sufficient sensitivity and specificity in the diagnosis of immune thrombocytopenia. British Journal of Haematology, 128(5): 698-702.
32. Lackland DT, Egan BM. Dietary salt restriction and blood pressure in World Health Organization - Primary prevention of essentialhypertension report of a WHO Scientific Group. Geneva, Switzerland: World Health Organization; Technical Report Series, 1982; 678.
33. Longo DL, Famci AS, Kaiper DL, Hauser SL et al. Harrisons principles of internal medicine, chapter diabetes mellitus 18th edition, USA, McGraw-Hill, 2012; 2: 2968-3002.

34. Lobbes MB, Kooi ME, Lutgens E, Ruiters AW, Lima Passos V, Braat SH, et al. Leukocyte counts, myeloperoxidase, and pregnancy-associated plasma protein a as biomarkers for cardiovascular disease: towards a multi-biomarker approach. Int J Vasc Med, 2010; 2010: 726207.
35. Linden MD, Jackson DE. Platelets: pleiotropic roles in atherogenesis and atherothrombosis. Int J Biochem Cell Biol, 2010; 42: 1762-6.
36. Lowe G. Can haemostatic factors predict atherothrombosis? Intern Emerg Med, 2011; 6: 497–501.
37. Mont ezano AC, Touyz RM. Molecular mechanisms of hypertension--reactive oxygen species and antioxidants: a basic science update for the clinician. Can J Cardiol, 2012; 28: 288-295[PMID: 22445098 DOI: 10.1016/j.cjca.2012.01.017].
38. McLarty DG, Athaida IA, Swai AB. Diabetesdetection in Tanzania. *Pract. Diab Dig.*, 1990; 7: 65–67.
39. Njolstad PR, Sagen JV, Bjorkhaug L, Odili S, Shehadeh N, Bakry D, Sarici, S. U., Alpay, F., Molnes, J., Molven, A., Sovik, O. and Matschinsky, F. M. (2003). Permanent neonatal diabetes caused by glucokinase deficiency: inborn error of the glucose-insulin signaling pathway. *Diabetes*., 52(11): 2854-60.
40. Osmond C, Barker DJ. Fetal, infant, and childhood growth arepredictors of coronary heart disease, diabetes, and hypertension inadult men and women. Environ Health Perspect, 2000; 108Suppl3: 545-553.
41. Ozcan F, Turak O, Durak A, Işleyen A, Uçar F, Giniş Z, Uçar F, Başar FN, Aydoğdu S. Red cell distribution width and inflammationin patients with non-dipper hypertension. *Blood Press*, 2013; 22: 80-85 [PMID: 22835009 DOI: 10.3109/08037051.2012.707336].
42. Raju SM, Raju B (2010). Illustrated medical biochemistry. 2nd Edition. Jaypee Brothers Medical Publishers ltd, New Delhi, India. 645pp.
43. Rowley WR, Bezold C. (2012)."Creating public awareness: state 2025 diabetes forecasts. "Population Health Management.
44. Shaw JE, Sicree RA, Zimmet PZ (2010). Global estimates of the prevalence of diabetes for 2010 and 2030. Diabetes Res. Clin. Pract., 87: 4-14.
45. Sahin I, Karabulut A, Avci II, Okuyan E, Biter HI, Yildiz SS, CanMM, Gungor B, Dinckal M, Serebruany V. Contribution of plateletsindices in the development of contrast-induced nephropathy. *Blood Coagul Fibrinolysis,* 2015; 26: 246-249 [PMID: 24695089 DOI:10.1097/MBC.0000000000000107].

46. Sahan E, Polat S. [Neutrophil to lymphocyte ratio is associatedwith more extensive, severe and complex coronary artery diseaseand impaired myocardial perfusion]. *Turk Kardiyol Dern Ars.*, 2014; 42: 415 [PMID: 24899494 DOI: 10.5543/tkda.2014.87036].
47. Spencer CG, Felmeden DC, Blann AD, Lip GY. Haemorheological, platelet and endothelial indices in relation to global measures of cardiovascular risk in hypertensive patients: a substudy of the Anglo-Scandinavian Cardiac Outcomes Trial. *J Intern Med*, 2007; 261: 82-90[PMID: 17222171 DOI: 10.1111/j.1365-2796.2006.01735.x].
48. Tsounis D, Bouras G, Giannopoulos G, Papadimitriou C, Alexopoulos D, Deftereos S. Inflammation markers in essential hypertension. Med Chem., 2014; 10: 672-681 [PMID: 25102200 DOI: 10.2174/1573406410666140318111328].
49. Tsioufis C, Dimitriadis K, Selima M, Thomopoulos C, Mihas C, Skiadas I, et al. Low-grade inflammation and hypoadiponectinaemia have an additive detrimental effect on aortic stiffness in essential hypertensive patients. Eur Heart J., 2007; 28: 1162-9.
50. Yin W, Shanmugavelayudam SK, Rubenstein DA. The effect of physiologically relevant dynamic shear stress on platelet and endothelial cell activation. Thromb Res., 2011; 127: 235-41.
51. Zuberi BF, Akhtar N, Afsar S. Comparison of mean platelet volume in patients with diabetes mellitus, impaired fasting glucose and non-diabetic subjects. Singapore Med J., 2008; 49: 114-6.

Eectronicrefrences (ER)

ER 1 (https://en. Wikipedia.org/wiki/Diabetes)

ER 2 (https://en. Wikipedia.org/wiki/Hypertension)