Journal of Clinical and Medical Research

ISSN: 2582-4333
Akinlua I, et al, 2021- J Clin Med Res
Research Article

Plasma Activity of Antioxidants and Lipid Peroxidation Level Among Patients having Moderate and Severe Hypertension

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Accepted Date: 05-11-2021
Published Date: 06-11-2021

Abstract

Hypertension or high blood pressure and its complications is a major cause of morbidity and mortality all over the world. The development of hypertension has been linked to atherosclerosis formation and progression which in turn has its root in free radicals induced oxidative stress and antioxidants present. This work was undertaken to determine plasma activity of enzymatic antioxidants and lipid peroxidation level in patients with moderate and severe hypertension to establish a possible association between these parameters and progression of hypertension. A total number of 60 hypertensive patients that are freshly diagnosed made up of 30 moderate and 30 severe hypertensive patients with 30 relatively healthy subjects as control recruited from Wesley Guide Hospital, Ilesa, Osun State Nigeria was used for this study. Plasma activity of catalase, superoxide dismutase, glutathione peroxidase and plasma level of malondialdehyde (MDA) was determined in both patients and control subjects using standard methodologies. The results obtained was subjected to statistical analysis using two-way analysis of variance (ANOVA) and post-hoc Duncan test with ($p<0.05$) considered to be significant. Result of this study revealed a significant decrease ($P<0.05$) in the activity of the antioxidant enzymes considered. The plasma MDA in all the patients was raised but not statistically significant $p<0.05$ from result obtained for the control subjects. Progressive decrease in the activity of antioxidant enzymes in these patients and a possible oxidative stress as hypertension progresses as shown in this study could be a pointer to the fact that these molecules might influence greatly the progression of hypertension.

Keywords: Mild hypertension; Severe hypertension; Antioxidants; Lipid peroxidation.

Citation: Akinlua I, Asaolu MF, Oyeyemi OA, Ogundajo AT. Plasma Activity of Antioxidants and Lipid Peroxidation Level Among Patients having Moderate and Severe Hypertension. J Clin Med Res. 2021;3(3):1-5.
DOI: https://doi.org/10.37191/Mapsci-2582-4333-3(3)-070

Introduction

Hypertension is a chronic and long-term medical condition which present a persistently elevated blood pressure in the arteries. Hypertension were classified into three groups based on blood pressure level:

- Mild hypertension (Systolic pressure ranging from 120 to 139 mm Hg and diastolic pressure from 80 to 89 mm Hg.),
- Moderate hypertension (Having Systolic pressure of 140 to 159 mm Hg and diastolic pressure between 90 to 99 mm Hg.) and
- Severe hypertension (With Systolic pressure≥ 160 mm Hg and diastolic pressure ≥ 100 mm Hg [1].

Hypertension remains one of the most popular and widespread diseases of modern times, with adult's population having the disease expected to increase to a total of 1.56 billion by 2025 [2]. Interestingly, in 2017, based on recommendation for hypertension diagnosis threshold of 130/80mmHG, there is increase in its prevalence among the general population, it was further stated that the number of patients suffering from this disorder will gradually equal the number of normotensive individuals [3]. Uncontrolled high blood pressure is a major risk factor for stroke, heart failure, coronary artery disease, peripheral arterial disease, vision loss and chronic kidney disease [4,5]. Atherosclerosis remains a significant factor in hypertension and related cardiovascular complications. Increased oxidative stress due to raised level of free radical activities had been linked to atherosclerosis formation and progression [6]. The severity of hypertension tends to increase the risk of related and associated cardiovascular diseases which could be managed with proper understanding of the underlined metabolic changes involved in the development of hypertension. Antioxidant enzymes remain a vital means through which the body reduces the risk of free radical related atherosclerosis progression and the development of hypertension. There have been studies which documented the beneficial effects of antioxidant enzymes in reducing free radical related diseases including atherosclerosis [7-9]. By reducing potential free radicals' generation and increasing the intake of antioxidant enzyme rich foods or supplements, the body's ability to minimize the risk of free radical related health problems is enhanced. Free radical induced lipid peroxidation has been given a great deal of attention in relation to oxidative stress in vivo, a process that has been linked to atherosclerosis progression, which may be as a result of free radical reactions with diet-derived lipids in the arterial wall and serum to yield peroxides, and other substances which induced endothelial cell injury which produce changes in the walls. This is considered as the main molecular mechanisms behind oxidative damage to cell structures [10]. The extent of this damage can be assessed by estimating the plasma level of Malondialdehyde (MDA), a molecule produced during lipid peroxidation [11].

Methodology

Participants

There was a total of 90 participants recruited from Wesley guide Hospital, Ilesa, Osun State

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consisting thirty moderate hypertensive patients, 30 severe hypertensive patients as test and thirty relatively healthy individual used as control.

Ethical clearance and sample collection

Ethical clearance with protocol number HREC/27/04/2015/SSHO/58 was obtained from Specialist Hospital Osogbo Health Research Ethics Committee (SHOHREC). The participants were properly informed and their consent obtained, clinical history and their anthropometric parameters was taken with the aid of questionnaire. Venous blood was drawn from each subject into anti-coagulated bottles. The blood was subjected to centrifugation at 4000 rpm for 3 minutes and the plasma obtained was to determine the various biochemical parameters.

Determination of Parameters

Superoxide dismutase (SOD) activity

SOD activity in the plasma was analyzed by the method of Ookawara et al. (1998) [12].

Catalase activity

The activity of Catalase was colorimetrically determined using the method of Sinha (1972) [13].

Glutathione peroxidase (GPx) activity

The activity of GPx was determined using the method of Rotruck et al. (1973) [14].

Analysis of data

Data gotten from the parameters determined was subjected to one-way Analysis of Variance (ANOVA) and post-hoc Duncan test. The results were expressed as mean ± SEM (standard error of mean) with level of significance put at ($p<0.05$). Statistical significance was obtained at 95% confidence limit.

Results

Parameters	Control Subjects	Hypertensive Patients (Moderate)	Hypertensive Patients (Severe)
Age (Years)	22.38 ± 1.14^a	69.60 ± 1.14^b	65.20 ± 14.11^c
Weight (KG)	54.40 ± 7.93^a	71.20 ± 9.418^b	80.00 ± 22.64^c
Height (M)	1.63 ± 0.04^a	1.63 ± 0.08^a	1.63 ± 0.05^a
Blood/Pressure Systolic (mm/HG)	98.39 ± 19.49^a	151.80 ± 7.99^b	168.60 ± 12.72^c
Blood/Pressure Diastolic (mm/HG)	56.95 ± 10.58^a	73.80 ± 7.99^b	102 ± 9.33^c
Body mass Index (KG/M^2)	19.39 ± 2.85^a	26.88 ± 2.31^b	30.06 ± 8.10^c

Table 1: Anthropometric indices of moderate hypertensive patients, severe hypertensive patients and control subjects. Results were expressed as means ± standard error of mean, $P<0.05$, values with different superscript are significantly different.

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Parameters	Control Subjects	Hypertensive Patients (Moderate)	Hypertensive Patients (Severe)
SOD (U/mg protein)	32.01 ± 21.12^{a}	15.34 ± 13.15^{b}	10.46 ± 5.62^{c}
CAT(Units/ml)	1.76 ± 0.37^{a}	0.85 ± 0.47^{b}	0.50 ± 0.20^{c}
GPx (Units/ml)	1.14 ± 0.37^{a}	1.01 ± 0.12^{b}	0.88 ± 0.16^{c}
MDA (nmol/ml)	0.12 ± 0.04^{a}	0.17 ± 0.01^{a}	0.18 ± 0.03^{a}

Table 2: Plasma activity of antioxidants and plasma lipid peroxidation level of moderate hypertensive patients, severe hypertensive patients and control subjects. Results were expressed as means ± standard error of mean, $P<0.05$, values with different superscript are significantly different.

Discussion

Hypertension and its related cardiovascular complications remain an important factor responsible for high mortality and morbidity world over. The result in table 1 shows a significant increase ($p<0.05$) in the mean age of patients as hypertension progresses from mild to severe cases. Age remains an important non-modifiable risk factor in hypertension, therefore as people aged, more attention is needed in blood pressure monitoring and other factors predisposing to the development of hypertension. This support the outcome of a study by Adeloye et al., (2014) [15] who presented a report that prevalence of hypertension in older people is four times more than people aged 40years and younger. A significant increase $p<0.05$ in mean weight and body mass index from mild hypertensive patients to severe hypertensive patients occurs as shown in table 1. There is clear evidence of overweight in patients with severe hypertension. These findings support earlier report of Parker et al., (2016) [16] who reported a strong association between increasing BMI and raised blood pressure with risk of incident hypertension, and also Peter et al., (2017) [17] who reported a positive association between increasing weight and raised blood pressure in obese and overweight subjects. Plasma activity of SOD, CAT and GPx in moderate hypertensive patients was significantly reduced than that of normotensive subjects, there is a further significant reduction $p<0.05$ in the activity of these molecules from moderate to severe hypertensive patients showing a possible association between these parameters and hypertension progression. Similar finding was reported by previous research which support the result of this work [18]. The reported decrease in activity of antioxidant enzymes in these patients could be due to poor nutritional status and increased production of free radicals as a result of high blood pressure. The plasma MDA level shows a slight increase from mild to severe hypertensive patients. This is an indication of a possible presence of lipid peroxidation and oxidative stress in these patients [19].

Conclusion

This study reveals the need to monitor body weight in other to prevent overweight and obesity especially in older adults and a progressive decrease in the activity of the various antioxidant's enzymes and a possible oxidative stress as blood pressure increases

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from moderate to severe hypertension, which are factors that could be significant in the prevention of hypertension, control its severity and complications associated with it thereby reducing its mortality and morbidity.

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