European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 09, Issue 02, 2022

# Association between serum ferritin levels and elevated blood pressures: A case control study

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## Abstract

**Introduction:** Elevation of serum ferritin levels can result in major health issues. Increased oxidative stress, inflammation, and endothelial damage are all linked to elevated serum ferritin levels, which in turn raises the risk of hypertension.
**Aim:** Serum ferritin levels in patients with high blood pressure and a healthy control group were measured and compared in this study.
**Material and Methods:** The present study was a hospital-based observational and analytical study. The study was conducted over a period of 1 year on 60 patients. The study group comprised of 30 patients (not diagnosed with hypertension or on any treatment) and the control group comprised of 30 (age and gender matched) individuals. The levels of serum ferritin were analysed by the chemiluminescent method.
**Result:** The results of the present study showed that, the mean value of serum ferritin was 313.17 ± 173.86 ng/ml in study group and 169.50 ± 105.66 ng/ml in control group. The mean SBP was 137.53 ± 14.32 mm/Hg in study group and 121.60 ± 8.09 mm/Hg in control group. The mean DBP was 87.73 ± 8.83 mm/Hg in study group and 71.03 ± 9.56 mm/Hg in control group. The results of the present study indicate that the difference between the mean serum ferritin and mean SBP, mean DBP among the study group and control group was found to be significant statistically (p=<0.005).
**Conclusion:** The current study found a positive association between the mean serum ferritin levels and high blood pressure among the study participants.

**Keywords:** Hypertension (HTN), systolic blood pressure (SBP), diastolic blood pressure (DBP), serum ferritin

ISSN 2515-8260 Volume 09, Issue 02, 2022

## Introduction

Serum ferritin is one of the major protein in the human body that helps with the regulates iron homeostasis. Serum ferritin levels are a helpful clinical indicator for the amount of iron stored in the body. However, several studies have suggested that an iron overload may contribute to the generation of reactive oxygen species (ROS), hence raising oxidative stress and inflammation, which can lead to high blood pressure [1].

In south Asia, high blood pressure (BP) is the third most significant risk factor for the attributable burden of illness [2]. As a public health issue, hypertension (HTN) has a significant impact on India's cardiovascular health and healthcare systems [3, 4]. In India, 57 percent of stroke deaths and 24 percent of coronary heart disease deaths are directly linked to hypertension [5]. Along with coronary

**Table 1:** Comparison of systolic blood pressure (mm/Hg), Diastolic blood pressure (mm/Hg) and Ferritin levels (ng/ml) in study group

| | Study group | Control group | p value |
|---|---|---|---|
| Mean ± SD SBP (mm/Hg) | 137.53 ± 14.32 | 121.60 ± 8.09 | p<0.0001 |
| Mean ± SD DBP (mm/Hg) | 87.73 ± 8.83 | 71.03 ± 9.56 | p<0.0001 |
| Mean ± SD Ferritin (ng/ml) | 313.17 ± 173.86 | 169.50 ± 105.66 | p=0.0003 |

**Table 2:** Correlation of Ferritin levels (ng/ml) with SBP (mm/Hg) in study group

| No. of Patients | SBP (mm/Hg) Mean ± SD | Ferritin (ng/ml) Mean ± SD | r value | p value | Significance |
|---|---|---|---|---|---|
| 60 | 137.53 ± 14.32 | 313.17 ± 173.86 | ± 0.28 | <0.005 | S |

**Table 3:** Correlation of Ferritin levels (ng/ml) with DBP (mm/Hg) in study group

| No. of Patients | DBP (mm/Hg) Mean ± SD | Ferritin (ng/ml) Mean ± SD | r value | p value | Significance |
|---|---|---|---|---|---|
| 60 | 87.73 ± 8.83 | 313.17 ± 173.86 | ± 0.28 | <0.005 | S |

heart disease and stroke, complications of high blood pressure include heart failure, renal impairment, peripheral vascular disease, visual impairment and retinal haemorrhages [6]. Worldwide, it has been estimated that approximately 7.5 million deaths, or 12.8 percent of all annual deaths, are caused by high blood pressure. 6 By 2025, the prevalence of HTN in Indian men and women are expected to increase to 22.9 and 23.6 percent respectively [7]. Preventing and diagnosing HTN is critical for reducing the worldwide illness load and morbidity associated with mortality. Numerous authors have proposed that high serum ferritin levels can result in cellular membranes, lipids, proteins and deoxyribonucleic acid being damaged [8]. Various scholars have hypothesised a favourable association between blood ferritin levels and the likelihood of developing hypertension. However, clinical evidence for a causal link between elevated blood ferritin levels and hypertension incidence remains limited due to the scarcity of studies examining this interaction [9, 10].

Therefore, this study was done to examine the correlation between serum ferritin and increased blood pressure.

## Aims and Objective

The goal of this study was to figure out and compare serum ferritin levels in the study group (n=30), which were people with high blood pressure and the control group (n=30), who were individuals of the same age. The data was then statistically analysed.

ISSN 2515-8260 Volume 09, Issue 02, 2022

## Materials and Methods

The present hospital based observational and analytical study was conducted over a period of one year on 60 individuals. Newly confirmed individuals with increased blood pressure in the age group of 20 to 65 years were included in the study. The study sample constituted of 30 individuals (not diagnosed with hypertension or on any treatment) and the control group constituted of 30 age and gender matched individuals. The ferritin levels of all the participants were analysed by Chemiluminescent Microparticle Immunoassay technology with flexible assay protocols. The patients of Cardiac, renal, hepatic, and other systemic disorders in the past, Hemochromatosis, Anaemia, history of blood transfusion, iron, or vitamin therapy, Abuse of drugs or alcohol in the past, Infection evidence on a regular basis, as well as chronic inflammatory illnesses were excluded from the study.

## Statistical analysis

The data was analysed with Microsoft Excel and SPSS, and p-values were calculated using Pearson's correlation and t-test.

## Results

Table 1 shows that the maximum values of SBP and DBP (mm/Hg) were greater in the study group than in the control group, and serum ferritin levels (ng/ml) were statistically significant ($p<0.0001$) higher in the study group than in the control group. Table 2 reveals a statistically significant ($p=<0.005$) positive correlation between serum ferritin levels (ng/ml) and systolic blood pressure (mm/Hg). Table 3 reveals a statistically significant ($p=<0.005$) positive correlation between serum ferritin levels (ng/ml) and diastolic blood pressure (mm/Hg).

## Discussion

The present study showed a comparison of SBP (mm/Hg), DBP (mm/Hg) and ferritin levels (ng/ml) in study group (patients with increased blood pressure) and control group. It was observed that there was statistically significant difference between the SBP and ferritin levels, DBP and ferritin levels of study and control groups. The results of the study are consistent with the results of other studies conducted by various authors Piperno A *et al*. (2002) [11], Kim MK *et al*. (2012) [12], Galen P *et al*. (2010) [13], Choi B *et al*. (2015) [14]. In the present study elevated serum ferritin level were found to be associated with hypertension. There are several possible mechanisms explaining the association between serum ferritin levels and hypertension. One of which includes the development of atherosclerosis by elevated ferritin levels. Inflammation has a relationship with prevalent and/or incident hypertension and is also related to the ferritin level, which is also known as a positive inflammatory marker [12].

Serum ferritin concentrations reflect not only body iron stores but also systemic inflammation. 15 Also elevated body iron produces oxidative stress which can convert less reactive free radicals to more reactive free radicals like hydroxyl, hydroxide and super oxide anions. Elevated ferritin levels also causes damage to cellular membranes, lipids, proteins and deoxyribonucleic acid.8 Elevation of ferritin levels increase vascular oxidative stress and impairs vaso-reacitivity, which leads to inflammation, endothelial damage and consequently atherosclerosis. Atherosclerosis can develop and accelerate due to iron overload directed endothelial toxicity and oxidizing low-density lipoprotein and isoprostanes which are biomarkers for the oxidative stress. Atherosclerosis process follows after and the risk of hypertension can be increased.

ISSN 2515-8260 Volume 09, Issue 02, 2022

## Conclusion

The result of this analysis revealed that elevated serum ferritin levels were positively correlated with high blood pressure (p value=<0.05), presumably because elevated ferritin levels increase with increasing blood pressure. As a result, elevated ferritin levels contribute to increased vascular oxidative stress and impaired vaso-reactivity. This results in inflammation, endothelial damage, and ultimately atherosclerosis, which causes blood pressure to rise. The serum ferritin level can be an early predictor of the development of hypertension since the probability of incident hypertension was proportional to the ferritin level. Because of this fact health care professionals can use the measurement of serum ferritin levels to anticipate the development of hypertension in its early stages.

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