Int J Biol Med Res. 2025; 16(4): 8217-8221

Contents lists available at BioMedSciDirect Publications

International Journal of Biological & Medical Research

Journal homepage: www.biomedscidirect.com

Original Article

Correlation Of Serum Iron Biomarker and Hypertension in Post-Menopausal Women attending Mararaba Medical Center, North Central Nigeria.

Abriba S. P.[1], Osekweme V.[2],Osadolor B. H. [3]

[1]Department of Medical Laboratory Science, Faculty of Allied Health Sciences, Bingham University, Abuja – Keffi Road Nassarawa State, Nigeria.

[2]Department of Medical Laboratory Science, Faculty of Allied Health Sciences Bingham University Karu

[3]Professor Humphrey Benedo Osadolor, Department of Medical Laboratory Science, College of Medical Sciences, University of Benin, Edo State, Nigeria.

ARTICLEINFO

Keywords:
Menopause,
Age,
Women,
Hypertension,
Iron, Correlation

ABSTRACT

BACKGROUD: Studies suggest that iron level plays critical role in determining the severity of some health conditions associated with Post Menopausal Syndromes; One of such health conditions is hypertension. Menopause is a condition characterized by the permanent cessation of menstruation after the age range of 49 to 55. This study is aimed at evaluating the correlation of iron level and hypertension in post-menopausalwomen attending Mararaba Medical Center North Central Nigeria.METHOD: A total of 120 subjects were recruited into the case-control study. The subjects were grouped into post-menopausal women as study group (40) and non-menopausal women as control group (80), giving a ratio of 1:2. The serum iron (Ferratin) level and blood pressure (BP) were determined, using anenzyme linked immunosorbent assay and sphygnanometer respectively.RESULTS:The results show statistically significant level of ferratin, systolic blood pressure and diastolic blood pressure in post-menopausal subjects, p<0.001, relative to non-menopausal subjects who serves as control. Ferratin (633.69± 3.72), (168.15±3.43), Systolic BP (145.05±1.33), (115.44±0.44), Diastolic BP (106.3±1.69), (79.11±0.49). Significant correlation exists between ferratin iron level and hypertension in post- menopausal women.CONCLUSION:The study suggests that post-menopausal women present with high value of ferratin iron levels and high blood pressure; this represents a positive correlation. Therefore, iron rich food and supplements should be avoided or reduced during menopausal age.

© Copyright 2025 BioMedSciDirect Publications IJBMR -ISSN: 0976:6685.

Introduction

Iron plays avital role in hematopoiesis and oxygen distribution in the body system, iron is involved in many metabolic processes, such as the transfer of oxygen, the creation of deoxyribonucleic acid (DNA), and the movement of electrons. Iron's concentration in bodily tissues must be strictly controlled, though, since too much of it can cause tissue damage; iron can produce free radicals, which are harmful to human health[1].

Because of its low percentage absorption from the initial amount consumed, iron is ideally recycled and as such saved by the body. Iron homeostasis must be maintained by maintaining a steady balance between iron intake, transit, storage, and usage, because iron is needed for several cellular processes [2]. Mammalian iron homeostasis is regulated at the intestinal absorption level due to the lack of iron removal pathways.

Corresponding author:

Dr Abriba Simon Peter
1Department of Medical Laboratory Science,
Faculty of Allied Health Sciences,
Bingham University, Abuja – Keffi Road Nassarawa State, Nigeria.

Email: abriba.simon-peter@binghamuni.edu.ng
abribasimonpeter@yahoo.com
ORCID: https://orcid.org/0009-0008-0698-916X

© Copyright 2025 BioMedSciDirect Publications IJBMR -ISSN: 0976:6685.

Hemochromatosis or iron overload, which is defined as excess iron levels, is a medical condition divided into two categories; primary and secondary. Primary hemochromatosis is described as iron overload that is often inherited. Mutation of the HFE gene leading to two variants (C282Y and H63D), were discovered, linking them to primary iron overload. While the iron overload which arises from external influences, such as blood transfusion, hemolysis or dietary consumption, is referred to as secondary hemochromatosis[3].

Iron overload is a recognized risk factor for numerous acute and chronic illnesses such as liver damage, pancreatic islet cell damage, liver cirrhosis and diabetes. Based on previous studies, iron levels have shown to play a key role in determining the severity of these conditions.Another health condition where studies have shown a significant role of iron levels in its pathophysiology is post-menopausal hypertension.

Menopause is a condition characterized by the permanent cessation of menstruation after the age range of 49 to 55. This results in significant physiological changes and symptoms that are frequently referred to as Post-Menopausal Syndrome (PMS)[4].

Studies suggest that iron levels in such patients play a key role in determining the severity of some health conditions associated with PMS. One of such health conditions is hypertension. Although hypertension is a disorder in which the blood vessels have continuous elevated pressure beyond the threshold specified as normal for the age and gender, it is commonly recognized as high or raised blood pressure (WHO, 2023)[5].

Blood pressure is the force exerted by circulating blood against the walls of the body's arteries, the major blood vessels of the body. It is written as two numbers. The first (systolic) number represents the blood pressure in blood vessels when the heart contracts or beats. The second

(diastolic) number represents the pressure in the vessels when the heart rests between beats. Hypertension is diagnosed if, when it is measured on two different days and in different postures, the systolic blood pressure readings on both days is ≥ 140mmHg and/or the diastolic blood pressure readings on both days is ≥90mmHg. Blood pressure is typically lower in pre-menopausal women than in men[6].

However, after menopause, the prevalence of hypertension in women is significantly higher, due to the build-up of iron levels. As menstruation is known to be one of the major pathways for the excretion of iron, cessation of this physiological occurrence leads to buildup in iron stored in the system. This study is aimed at evaluating the correlation of iron level and hypertension in post-menopausal women attending Medical Center, Mararaba North Central Nigeria.

MATERIALS AND METHODS

A total of 120 subjects were recruited into the case-control study. The subjects were grouped into post-menopausal women as study group (40) and non-menopausal women(80), which were selected from the remaining cohort as controls based on matching criteria using a ratio of 1:2 for the cases and controls respectively. The serum iron level was determined, as well as the blood pressure for both the study group and control group.

Ethical Approval

Ethical approval was sought and obtained from the Ethical clearance committee of Health Research Ethics Committee Nasarrawa State with reference number NHREC Protocol No.: 18/06/2017.

Informed Consent

The purpose and protocol of the study were clearly explained to each patient and all participants were requested to voluntarily sign the consent forms in their own hand writing as proof of willingness to provide samples for the research work.

Exclusion Criteria

Women who are below 18years and above 65years, women who are pregnant, who were suffering from any form of ailment and did not give their consent were excluded from the study.

Inclusion Criteria

Women within the age range 18years to 65years, who gave their consent to participate were included.

Data Collection

Prior to specimen collection, demographic information of the participants was obtained through administration of prepared questionnaires. Interpreter was provided for translation where it was necessary. Each questionnaire had a unique participant identification number (PIDN). The first part of the questionnaires contained the bio data of the patients e.g. sex, age etc.

For reason of privacy, all data were kept confidential in accordance with World Medical Association declaration of Helsinki (WMA, 2024). For each participant, only the PIDN was recorded on the laboratory forms (no names). All the filled questionnaires were destroyed after data entry had been completed.

Sample Collection

5ml of venous blood sample was collected without stasis from each participant into plain bottles,Samples in plain bottles was allowed to clot, after which it was centrifugated at 4000rpm for 10 minutes; and the serum was extracted into clean vial for analysis.The Enzyme Linked Immunosorbent Assay was used to determine the serum ferritin levels, and the blood pressure was determine using sphygnanometer.

Statistical Analysis

Data obtained from the biochemical analysis were reported as mean ± standard deviation and the difference among the means will be analyzed using Student's t-test with Statistical Package for Social Sciences (SPSS) version 25.0. P-values < 0.001were be considered statistically significant,while Pearson regression coefficient correlation was used for correlation.

RESULTS

A total of 120 participants were recruited into the study,they were divided into study group, which consist of 40 subjects which have attained the post-menopausal age; and 80 control subjects which are non-menopausal. Comparison of quantitative variables were done using independent samples' T-test while qualitative variables were analyzed using Chi-square test.

Results were presented in tables and charts of mean and standard deviation, as well as percentages where applicable. Level of significance was set at P < 0.001. Pearson regression coefficient ® was used to determine the correlation of the iron marker and the blood pressure (Systolic and Diastolic), as shown in Figures 3, 4, 5, 6, 7, and 8 below.

Table1 shows selected socio-demographic characteristics across the participants with the results in a table of mean and standard deviation. It was observed that there were no significant differences, except in age as shown in table 1 below.

Table 1: Socio-demographic characteristics between hypertensive (tests) and controls

VARIABLE	HYPERTENSIVE (n=40) Mean SD	NON-HYPERTENSIVE 9n=80)	P-Value	Remark
Age(Years)	58± 0.20	48± 0.10	0.184	<0.001
Weight (Kg)	71.6± 1,20	71.3± 2.00	0.93	>0.001
Height(Cm)	161.0± 2.00	159.2± 2.01	0.365	>0.001
BMI (Kg/ m3)	27.7± 0.30	28.6 ±0.20	0.789	>0.001

Fig. 1. Socio-demographic characteristics between hypertensive (tests) and controls.

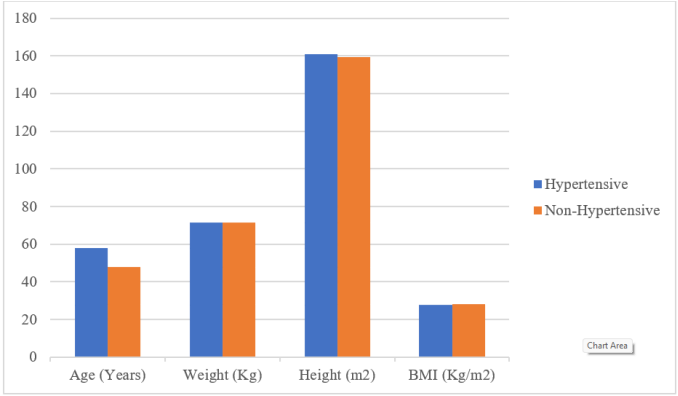


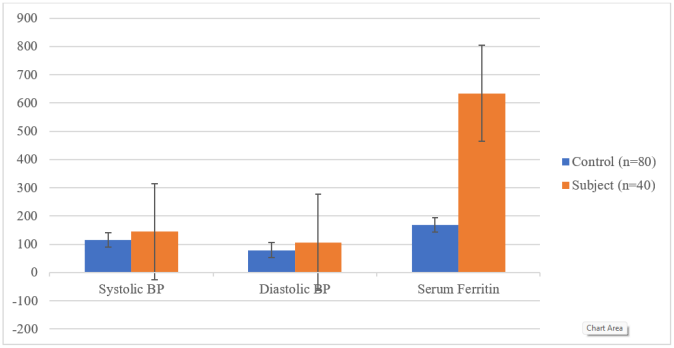
Table2 describes the mean comparison in blood pressure reading and ferritin value between hypertensive and normotensive controls. The results showed statistically significant difference p<0.001, between the study subjects and the control subjects as represented in table2 and figure 2 below; also, the study subjects exhibit a statistically significant increase in mean serum ferritin as well as systolic and diastolic blood pressure.

Table 2 Shows the Comparison of Systolic Blood pressure, Diastolic Blood pressure and Serum Ferritin level of Control and Study Subjects.

Parameters	Control (n=80) Non-menopausal	Study Subjects (n=40) Post-menopausal	p-value	Remark
Systolic BP	115.44 ± 0.44	145.05 ± 1.33	< 0.001	SS
Diastolic BP	79.11 ± 0.49	106.34 ± 1.69	< 0.001	SS
Serum Ferritin	168.15 ± 3.43	633.69 ± 3.72	< 0.001	SS

Values are Expressed as mean ± SEM, n= number of subjects; SS = Statistically Significant; P-value < 0.001.
P-value >0.001; not Statistically Significant.

Fig. 2. Shows the bar charts of Systolic Blood pressure, Diastolic Blood pressure and Serum Ferritin level of Control and Post-menopausal Subjects.



There are positive correlations between the Iron Ferritin level with the blood pressure as represented in the figures 3,4,7, &8 below; while figures 5 &6 shows negative correlation.

Figure 3:Correlation between Serum ferritin and Systolic Blood Pressure (mmHg) in hypertensive individuals, were statistically significant (p=<0.288), (r=0,200).

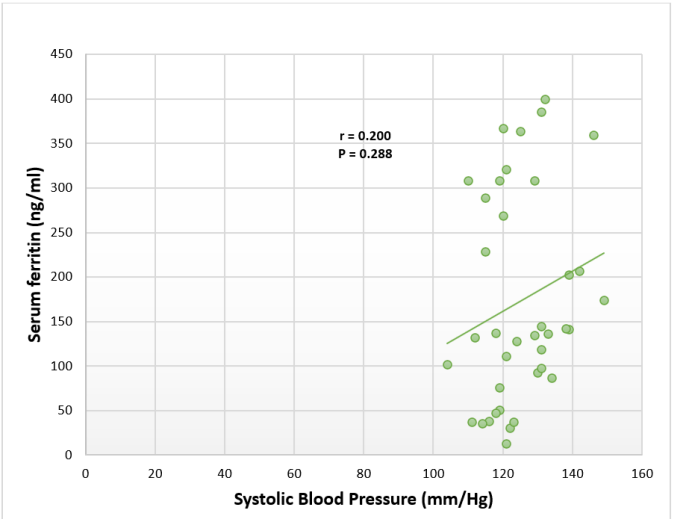
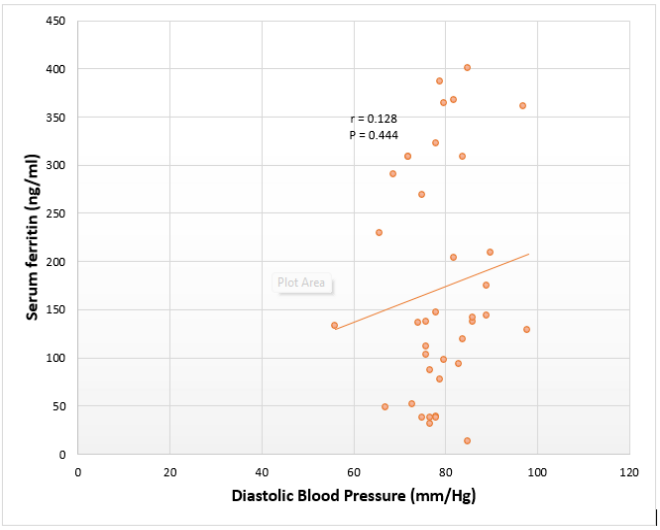


Figure 4:Correlation between Serum ferritin and Diastolic Blood Pressure(mmHg) in post-menopausal study subjects, were statistically significant (p=<0.44), (r=0,128)



NON-MENOPAUSAL

Fig 5: Negative correlation.

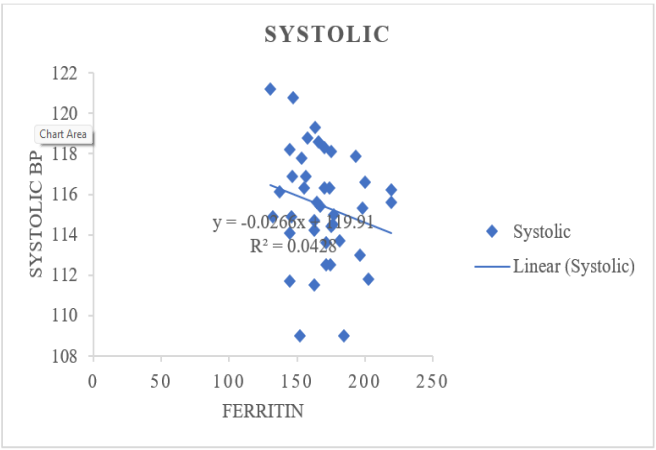


Fig 6: Negative correlation.

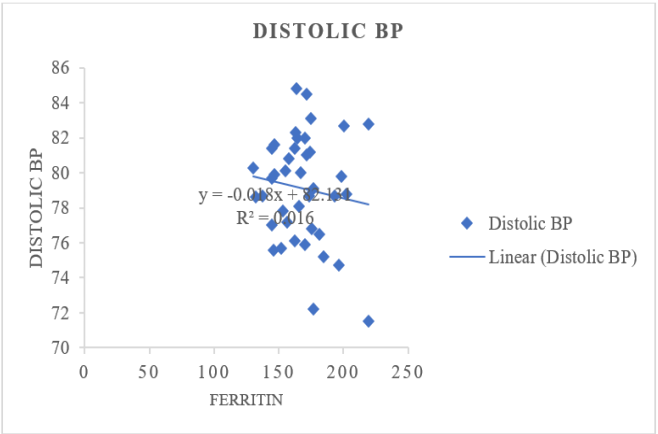
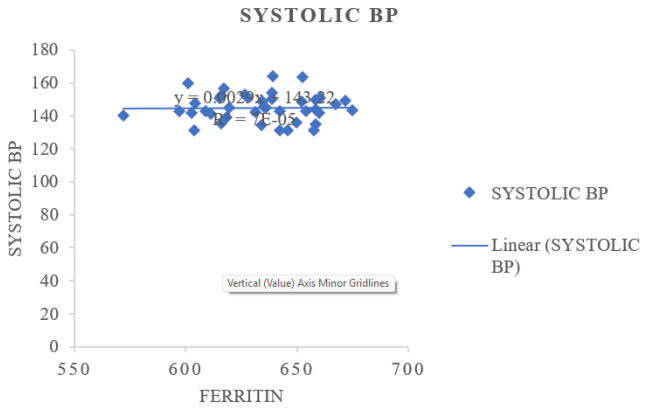


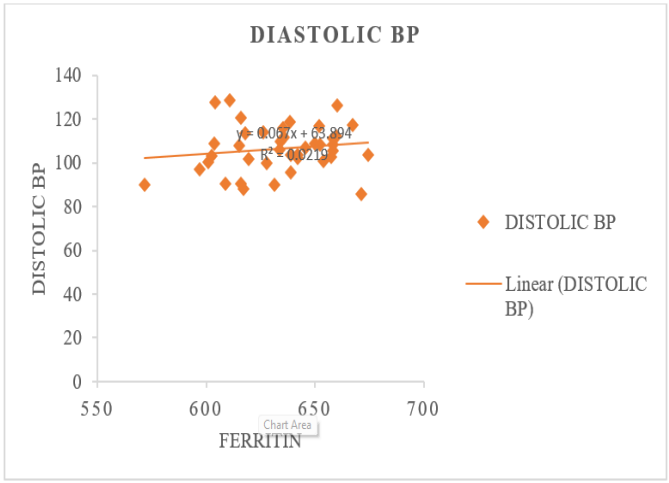
Fig 7: Ferritin shows Positive correlation with Systolic BP.

Fig 8: Ferritin shows positive correlation with Diastolic BP.



DISCUSSION

In this study, it is observed that post-menopausal women present with



high iron level and blood pressure relative to the non-menopausal control subjects, which is in tandem with the study carried out by Sullivan[7]and Erahboret al. [8]. Serum iron is the measure of how much iron is in serum, post-menopausal women conserve iron as menstrual cycles and periods ceases, since the major route of iron loss is by blood loss, this may account for the increase in serum iron of post-menopausal women.

Ferritin is the major storage form of iron in the body and it is an acute phase reactant. In pre-menopausal women, there are physiological process that leads to loss of iron at intervals such as menstruation, pregnancy and lactation. Following loss of iron, the stored iron is depleted to be mobilized for red cell production and for body's metabolic processes;this may result in decrease ferritin in pre-menopausal women.

The natural physiologic system in young women is high estrogen and low iron [8]. The reverse is true in older women: Low estrogen and high iron as shown by high level of ferritin observed among post-menopausal women in this study [8].

Studies have shown that increased iron could lead to oxidative stress and sensitize the skin to ultra violet ray exposure. Urinary levels of 8-oxo-2'-deoxyguanosine, a marker of oxidative DNA adducts, has been shown to increase with serum ferritin levels in men and women[9], this, ultimately leads to vasoconstriction and hypertension if prolonged.

Packed cell volume and total iron binding capacity are increased in post-menopausal than pre-menopausal in agreement with work done by Achie et al. [10] which recorded increased packed cell volume among post-menopausal women and supported by world health organization[11].

Hypertension is a cardiovascular disorder arising from the chronic pressure exerted by blood on the walls of arterial blood vessels. Research investigations have shown that iron overload is a risk factor for hypertension amongst individuals [6]. In this study, post-menopausal women demonstrated hypertension and iron overload using ferritin as a marker, shows a comparison of high Systolic blood pressure (SBP),

Diastolic blood pressure (DBP) and ferritin levels in the study group (post-menopausal women), relative to the control group (pre-menopausal women), ($p<0.001$). This is consistent with previous reports by [12,13, 14, 15], who reported similar findings. There are positive correlations between high ferratin level and high blood pressure in post-menopausal women that present with hypertension in this study.

This finding can be explained by the fact that increased iron levels lead to vascular inflammation which further results in vascular disturbance including nitric oxide depletion and oxidative stress; some post-menopausal women are consumers of supplements. These supplements usually contain iron or promote iron absorption from dietary sources leading to increased in iron ferratin in post-menopausal women.

The limitation of the study is that it is based only on one form of iron biomarker, and small sample size. The dietary information of the participants was not taken during the study; these serves as a gap and an opportunity to carry out further study on the role of iron supplements in post-menopausal women in hypertensive post-menopausal women.

CONCLUSION

The study shows a positive correlation between iron ferratin marker and high blood pressure (Systolic and Diastolic) in post-menopausal women. This demonstrates that hypertension is a disorder characterized by prolonged elevated blood pressure in the blood vessels.

This study showed manifestation of high systolic and diastolic blood pressure, evidenced by marked increase in ferritin levels. It is therefore clear that increased iron ferritin marker can lead to an increase in blood pressure and consequently, hypertension in post-menopausal women; therefore, the severity of essential hypertension was directly proportional to the serum ferritin level as an early predictor of the development of hypertension. Uptake or ingestion of food supplements by post-menopausal women is an increased risk factor for the development of hypertension.

RECOMMENDATION

Post-menopausal women should monitor the status of their iron profile regularly. Furthermore, monitoring of iron status should be part of general health assessment of post-menopausal women to prevent iron overload which leads to hypertension.In post-menopausal women,food supplements should be consumed with care, ensuring reduced intake of supplements promoting the increment or uptake of iron.Post-menopausal women, who are fit to donate blood, should be encouraged to donate regularly.

AUTHORS CONTRIBUTIONS

ASP involved in the conception of the study, analysis of the data, and writing of the manuscript. OV, involved in the collation and analysis of data. OBH was involved in correction and proof reading of the manuscript All the Authors has read the manuscript and have agreed to the publication of the manuscript.

ACKNOWLEDGEMENT

We appreciate and thank the staff of Mararaba Medical Center for their support and assistance during the period of the study.

CONFLICT OF INTEREST

The Authors declares that no conflict of interest exists.

FUNDING

None received.

REFERENCES

[1] Abbaspour, N., Hurrell, R., &Kelishadi, R. (2014). Review on iron and its importance for human health. Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences, 19(2), 164–174.

[2] Lieu, P. T., Heiskala, M., Peterson, P. A., & Yang, Y. (2001). The roles of iron in health and disease. Molecular aspects of medicine, 22(1-2), 1–87.

[3] McDowell, L. A., Kudaravalli, P., & Sticco, K. L. (2022). Iron Overload. In StatPearls. StatPearls Publishing.

[4] Koothirezhi, R., & Ranganathan, S. (2022). Postmenopausal Syndrome. In StatPearls. StatPearls Publishing.

[5] World Health Organization. (2023) Hypertension. Retrieved from https://www.who.int/news-room/fact-sheets/detail/hypertension

[6] Lima, R., Wofford, M., Reckelhoff, J. F. (2012). Hypertension in postmenopausal women. Current hypertension reports, 14(3), 254-260.

[7] Sullivan, J.L., 2003. Are menstruating women protected from heart disease because of, or in spite of, estrogen? Relevance to the iron hypothesis. Am. Heart J., 145: 190-194. 1

[8] Erhabor, O., K. Ibrahim, N. Isah, Y. Abdulrahaman and I. Zama. (2017). Ferritin level in pre and postmenopausal women attending usmanudanfodiyo university teaching hospital sokoto. Haematol. Int. J., Vol. 1, No. 2. 10.23880/HIJ-16000110.

[9] Milman, N., K.E. Byg, L. Ovesen, M. Kirchhoff and K.S.L. Jürgensen, (2003). Iron status in Danish women, 1984–1994: A cohort comparison of changes in iron stores and the prevalence of iron deficiency and iron overload. Eur. J. Haematol., 71: 51-61.

[10] Achie, L.N., K.V. Olorunshola and M. Mabrouk.(2011). A study of some red cell indices in menopausal women in Zaria, Nigeria. Asian J. Med. Sci., 3: 154-157.

[11] WHO., (2001). Iron deficiency anemia. assessment, prevention and control. Guide Program. Manage., 2001: 47-62.

[12] Piperno, A., Trombini, P., Gelosa, M., Mauri, V., Pecci, V., Vergani, A., Salvioni, A., Mariani, R., & Mancia, G. (2002). Increased serum ferritin is common in men with essential hypertension. Journal of hypertension, 20(8), 1513–1518.

[13]Kim, M. K., Baek, K. H., Song, K. H., Kang, M. I., Choi, J. H., Bae, J. C., Park, C. Y., Lee, W. Y., & Oh, K. W. (2012). Increased serum ferritin predicts the development of hypertension among middle-aged men. American journal of hypertension, 25(4), 492–497.

[14] Lee, D. H., Kang, S. K., Choi, W. J., Kwak, K. M., Kang, D., Lee, S. H., & Lee, J. H. (2018). Association between serum ferritin and hypertension according to the working type in Korean men: the fifth Korean National Health and nutrition examination survey 2010-2012. Annals of occupational and environmental medicine, 30, 40.

[15] Harrison-Benard, L.M., & Raji, L.(2000). Postmenopausal hypertension. Current hypertension reports, 2(2), 202-207.

© Copyright 2025 BioMedSciDirect Publications IJBMR -ISSN: 0976:6685.