SAR Journal of Medicine

Abbreviated Key Title: *SAR J Med*
Home page: https://sarpublication.com/journal/sarjm/home
DOI: 10.36346/sarjm.2022.v03i03.003

ISSN 2707-773X (P)
ISSN 2709-6920 (O)

Original Research Article

Evaluation of Iron Profile among Ischemic Heart Disease Patients in Shendi City, Sudan

Wafaa Bashir Haj Ahmed[1], Rashid Eltayeb Abdalla[2,3], Ghanem Mohammed Mahjaf[4], Hamza A. Hassan[1], Tarig Mohamed Ahmed Mohamed[5], Mosab Nouraldein Mohammed Hamad[6*]

[1]Department of Hematology, Faculty of Medical Laboratory Sciences, Shendi University, Sudan
[2]Faculty of Medicine and Surgery, Shendi University, Sudan
[3]Faculty of Medicine and Surgery, Ahfad University for Women, Sudan
[4]Department of Medical Microbiology, Faculty of Medical Laboratory Sciences, Shendi University, Sudan
[5]Department of Medicine, Faculty of Medicine and Health Sciences, Nile Valley University, Atbara, Sudan
[6]Department of Parasitology and Medical Entomology, College of Health and Allied Sciences, St. Joseph University in Tanzania, Dar Es Salaam, Tanzania

***Corresponding Author:** Mosab Nouraldein Mohammed Hamad
Department of Parasitology and Medical Entomology, College of Health and Allied Sciences, St. Joseph University in Tanzania, Dar Es Salaam, Tanzania

Article History: | Received: 17.04.2022 | Accepted: 25.05.2022 | Published: 29.05.2022 |

Abstract: ***Background:*** Ischemic heart disease (IHD), is a group of diseases that includes: stable angina, unstable angina, myocardial infarction, and sudden cardiac death. It is within the cluster of cardiovascular conditions of which it is the multiple expected kinds. Iron is an essential trace element. It has a pivotal role in maintaining various cellular functions and enzyme reactions; whereas, iron overload has been known as a risk factor in the progression of atherosclerosis. Abnormal deposition of iron in the heart cause hemochromatosis and dilated cardiomyopathy and this causes ischemic heart disease. This study aimed to investigate the role of serum iron, serum ferritin, and total iron-binding capacity (TIBC) in the causation of coronary heart disease (CHD) and their relationship with other risk factors of CHD. ***Methods:*** This is a cross-sectional case-control prospective analytical study conducted at Al-Mc Nemir University Hospital in Shendi town to evaluate the iron profile in ischaemic heart disease patients in the period between (March 2018—July 2018). The study included (50) patients who were diagnosed with ischaemic heart disease and the study groups were compared with a mean of the normal value. Serum iron, ferritin, and TIBC were estimated by spectrophotometer. Data was collected using a structured face-to-face questionnaire and the (SPSS) version (11.5) program was used for data analysis. ***Results:*** The study revealed that the ischaemic heart disease patients were; (40%) male and (60%) female, and the mean age was (57.612 ± 28.24), with a range of (36-65) years distributed as (96%). The study showed that the mean of s. iron was 203.9ug/dl (*p.value* 0.170), the mean of s. ferritin was 207.6ug/dl(*p.value* 0.447), the mean of TIBC was 663.0ug/dl(*p.value* 0.281) when compare with the mean of normal value. No significant difference was found between iron profile and CHD. Serum iron and serum ferritin levels are elevated in patients with CHD when compared with normal values. TIBC levels were lower in patients than normal values. When body iron was analogized with different risk factors (like smoking, hypertension, diabetes mellitus, tobacco, etc) of the condition it was found to be seriously raised. ***Conclusion:*** The study concluded that the level of serum iron, ferritin, and TIBC might not be associated with coronary heart disease.

Keywords: Ischaemic heart disease, Serum Iron, Serum Ferritin, TIBC, coronary heart disease.

INTRODUCTION

Cardiovascular disease *(CVD)* is a class of diseases that involves the heart, the blood vessels (arteries, capillaries, and veins), or both [1]. CVDs refer to any disease that affects the cardiovascular system, principally cardiac diseases, vascular diseases of the brain and kidney, and peripheral arterial diseases [2]. The causes of cardiovascular diseases are diverse but atherosclerosis and/or hypertension are the most common [3]. Additionally, with aging come several physiological and biochemical changes that alter cardiovascular function and lead to subsequently increased risk of cardiovascular diseases, even in healthy asymptomatic individuals [4]. CVDs are the leading cause of death. In 2008, (30%) of all global deaths is attributed to cardiovascular diseases. Deaths caused by cardiovascular diseases are also higher in low and middle-income countries as over (80%) of all global deaths caused by cardiovascular diseases

Citation: Wafaa Bashir Haj Ahmed, Rashid Eltayeb Abdalla, Ghanem Mohammed Mahjaf, Hamza A. Hassan, Tarig Mohamed Ahmed Mohamed, Mosab Nouraldein Mohammed Hamad (2022). Evaluation of Iron Profile among Ischemic Heart Disease Patients in Shendi City, Sudan, *SAR J Med*, *3*(3), 36-40.

occurred in those countries [5]. It is also estimated that by 2030, over (23) million people will die from cardiovascular diseases annually [5, 6]. The causes, diagnosis, prevention, control, and/or treatment of all forms of cardiovascular diseases remain active fields of biomedical research, with hundreds of scientific studies being published every week. In 2013 coronary artery disease *(CAD)* was the most common cause of death globally, resulting in (8.14) million deaths (16.8%) up from (5.74) million deaths (12%) in 1990 [7]. The risk of death from (CAD) for a shared age has decreased between 1980 and 2010, particularly in progressive countries [8]. The number of cases of *(CAD)* for a given age has also decreased between 1990 and 2010 [9]. In the United States in 2010 about (20%) of those over (65) had *(CAD)*, while it was present in (7%) of those (45 to 64yrs), and (1.3%) of those (18 to 45yrs) [10]. Rates are higher among men than women of a given age [10]. The Sudan Household Survey *(SHHS)* reported a prevalence of (2.5%) for heart diseases. Hypertensive heart disease *(HHD)*, rheumatic heart disease *(RHD)*, ischaemic heart disease *(IHD)*, and cardiomyopathy constitute more than (80%) of *(CVD)* in Sudan [6]. Heart diseases are a consequential reason for morbidity and mortality in Sudan. The tetrad of hypertension, *(RHD)*, *(IHD)*, and cardiomyopathy include the bulk of *(CVD)*. Hypertension is prevalent, with poor control rates [11]. Most *CVDs* can be controlled by managing risk factors such as tobacco use, unhealthy diet and obesity, physical inactivity, high blood pressure, diabetes, and raised lipids. More additional than half of the deaths due to heart illness in 2009 were in men. Coronary heart disease *(CHD)* is the most common type of heart disease, killing more than (385,000) people annually **[**6**]**. Ischaemic heart disease is accompanied by progressive mechanical obstruction, dynamic obstruction, plaque inflammation, instability, and rupture, followed by superimposed thrombosis. Clinicians have used different instruments to aid clinical estimation and to improve their ability to identify the "vulnerable" patient at risk for *CVD*, as indicated by a recent National Institutes of Health *(NIH)* panel [12, 13]. Biomarkers are one such tool to better identify high-risk individuals, diagnose disease conditions promptly and accurately and effectively prognosticate and treat patients with the disease. A biomarker may be estimated on a biosample (as a blood, urine, or tissue test), it may be a recording received from a person (blood pressure, Electrocardiogram, or Holter), or it may be an imaging test (echocardiogram). Normally, very small quantities of iron are present in most cells of the body, in plasma, and other extracellular fluids and the body rigorously conserves its iron supply, so that (0.1%) of the body's iron content is lost daily, mostly in desquamated cells[14]. Iron readily forms complexes with certain ligands and can participate in redox chemistry between the ferrous (Fe(II)) and ferric (Fe(III)) states, allowing iron to fill many biochemical roles as a carrier of other biochemically functional substances (e.g., oxygen) and as a mechanism in redox and electron transfer responses (e.g., via various cytochromes). Iron's increased activity is a two-edged sword, and complimentary iron ions in the body also experience destructive chemistry, predominantly in catalyzing the construction of poisonous free radicals. Iron play role in the process of atherosclerosis by catalyzing the formation of free radical and also this contributes to reperfusion damage. High serum ferritin concentration was associated with an increased risk of myocardial infarction, independent of major cardiovascular risk factors. Abnormal deposition of iron in the heart cause hemochromatosis and dilated cardiomyopathy and this causes ischemic heart disease.

MATERIALS AND METHODS

Study design

This is an analytical laboratory-based hospital case-control study to evaluate the iron profile in ischae mic heart disease patients in Al-Mc Nemir University H ospital.

Study duration
From March to July 2018

Study setting

The study was conducted at Almek Nimir University Hospital which is located in Shendi city, Sudan.

Study population

A total of fifty samples were collected from th e Study group of ischemic heart patients.

Ethical considerations

The consent of the selected individuals to the s tudy was taken after being informed of all detailed obje ctives of the study and it is health emphasis in the future

DATA COLLECTION

Data was collected using a self-administrated p re-coded questionnaire which was specifically designed to obtain information that helped in the study.

Blood Sampling

3 mL venous blood was collected using a sterile disposable plastic syringe after cleaning the venipuncture area with (70%) ethanol; the blood was collected in a plain container and separated by centrifugation to obtain serum.

Materials

Chemical methods were used to measure the iron profile (serum iron and TIBC) was done by using a Biosystem 350 semi-automated spectrophotometer and serum Ferrtin (latex) causes agglutination of latex particles coated with anti-human ferritin antibodies. The agglutination of the latex particles is proportional to the ferritin concentration and can be estimated by

turbidimetry.

DATA ANALYSIS

The collected data code is in the master sheet and proceeds for analysis using SPSS version 11.5. (Mean, standard deviation, *P.value*).

RESULT

Fifty serum samples from patients with ischemic heart diseases in Al-Mc Nemir Hospital were used to estimate iron profile, with an age range from (5– 65) years. Atotal of (50) blood samples were collected from ischemic heart disease patients including frequency of gender were 20 males (40%) and 30 females (60%), frequency of agegroups (36-65) years 48(96%). The average age of patients with ischemic heart disease in the study was (57.612 ± 28.24), with a range of (36-65) years (Table 1). Participation in risk factors for ischemic heart disease reflected that; 35 (70%) were HTN patients, while 15 (30%) were not. On the other hand, 30 (60%) were *DM* patients, while the remaining 20 (40%) were not. Furthermore, 10 (20%) of the patients were smokers, while 40(80%) of them were not. Regarding family history, of the patients, 25 (50%) with no family history of ischemic heart disease, and 25 (50%) were a family history (Table 2). According to diet, patients with ischemic heart disease showed that; 15(30%) were drinking a cup of tea in the range (1-2) cups, on the other hand, 35(70%) were drinking a cup of tea in the range (3-5). 49(98%) of patients were drinking tea immediately after the meal while 1(2%) were not (Table 3). Patients with ischemic heart disease received blood transfusions were 5(10%) while 45(90%) were not. On the other hand, 5(10%) of patients suffer from anemia while 45(90%) were not. Furthermore, 25 (50%) were with respiratory problems while 25(50%) were not. 35 (70%) patients were treated with tablets (aspirin, clopidogrel) while 15 (30%) were treated by injection (cleaxacin injection) (Table 4). The mean normal value of S. iron was (117µg/dl), TIBC was (350µg/dl), and S. ferritin was (110µg/dl). The table showed that the mean of S. Iron in ischemic heart disease patients was (203.9µg/dl) the mean of TIBC was (663.0µg/dl), and the mean of S. ferritin was (207.6µg/dl) (Table 5). The mean of S. iron of IHD in males was (264.2µg/dl), while in females with IHD was (179µg/dl) with *P.value* (0.412) and the mean of S. iron in patients with HTN was (244.2µg/dl) while (192µg/dl) was not hypertensive but with *P. value* (0.121) (Table 6). The mean of TIBC of IHD males was (157.2µg/dl) while in females was (352.6µg/dl) with *P. value* (0.542). And the mean of TIBC of patients with HTN was (150µg/dl) while (246µg/dl) were not hypertensive but with a P .value (0.614) (Table 7). The revealed that the mean of ferritin in patients with IHD males was (206.3µg/dl) while in females was (162.2µg/dl) with *P. value* (0.321). On the Other hand, the mean of S. ferritin in patients with HTN was (200µg/dl) while (179.2µg/dl) was not hypertensive but with *P. value* (0.101) (Table 8).

Table-1: Demographic distribution according to study group

Characteristic		Frequency	Percent %
Sex	*Male*	20	40%
	Female	30	60%
Age	5-18yrs	1	2%
	19-35	1	2%
	36-65	48	96%

Table-2: Distribution of study population according to risk factors

Characteristic		Frequency	Percent %
HTN	*Yes*	35	70%
	No	15	30%
DM	*Yes*	30	60%
	No	20	40%
Smoking	*Yes*	10	20%
	No	40	80%
Family history	*Yes*	25	50%
	No	25	50%
Kidney problem	*Yes*	10	20%
	No	40	80%

Table-3: Distribution of study population according to diet

Characteristic		Frequency	Percent %
Drink tea	1-2*cup*	15	30%
	3-5*cup*	35	70%
Immediately drink after meal	*Yes*	49	98%
	No	1	2%

Table-4: Demographic distribution of ischemic heart disease patients according to disease and treatment

Characteristic		Frequency	Percent %
Blood transfusion	*Yes*	5	10%
	No	45	90%
Anemia	*Yes*	5	10%
	No	45	90%
Respiratory problem	*Yes*	25	50%
	No	25	50%
Treatment	*Tablet*	35	70%
	Injection	15	30%

Table-5: Mean and STD in ischemic heart disease according to iron profile

	No	Mean µg/dl	STD	P. Value
S. iron	50	203.9	184.4	0.170
TIBC	50	663.0	591.0	0.281
S. ferritin	50	207.6	180.1	0.447

Table-6: Relationship between gender and hypertension according to S. iron

	Gender	Mean µg/dl	p.value
Gender	*Male*	264.2	
	Female	179	0.412
Hypertension	*Yes*	244.2	
	No	192	0.121

Table-7: Relationship between gender and hypertension according to TIBC

	Gender	Mean µg/dl mean	p.value
Gender	*Male*	157.2	
	Female	352.6	0.542
Hypertension	*Yes*	150	
	No	245	0.614

Table-8: Relationship between gender and hypertension according to S. ferritin

	Gender	Mean µg/dl mean	p.value
Gender	Male	206.3	
	Female	162.2	0.321
Hypertension	Yes	200	
	No	179.2	0.101

DISCUSSION

Ischaemic heart disease (IHD), is a group of diseases that includes stable angina, unstable angina, myocardial infarction, and sudden cardiac death [15]. The study included (50) samples, (40%) male and (60%) female, and the average age of the patients with ischaemic heart disease under study was (57.612 ± 28.24). The results of the study denoted that hypertensive patients were at high risk of IHD and showed an increased prevalence. Also, the study indicated diabetic risk factors for the disease but less than hypertension. Statistical analysis of gathered data revealed that the mean of serum iron, TIBC, and S. ferritin in ischemic heart diseases was (203.9 µg/dl), (663.0 µg/dl), (207.6 µg/dl) respectively. The degree of confidence was more than (0.05) indicating insignificant variation between case and normal value in iron profile i.e.; ischemic heart disease did not affect iron profile level. The findings elucidated that the mean of S. iron in males was (264.2µg/dl) while in females was (179µg/dl) when compared together it showed an insignificant difference (*P. value* 0.412). Also, the results show that the mean of TIBC in males was (157.2µg/dl) and in females (352.6µg/dl) and this result showed insignificant variation (*P. value* 0.542).On the other hand, the result prevailed that the mean of S. ferritin in males was (206.3µg/dl) and in females was (162.2µg/dl) which showed an insignificant statically value, (*P. value* 0.101). The finding of this recent study confirmed an insignificant variation in hypertensive patients with ischemic heart disease and iron profile. This study agreed with a study conducted by (Das De, *et al.,* 2015) which suggested that there was no significant association between the marker of iron status and IHD [16]. This study was in disagreement with the study performed by (Suuny Chopra, *et al.* 2015) which confirmed that there was a significant elevation in S. iron and ferritin in patients with IHD and there was a significant decrease in TIBC [17].

CONCLUSION

Iron and S. ferritin were elevated in ischemic heart disease patients. TIBC was lower in ischemic

heart disease patients. Iron and S.ferritin were high in males than in females. Hypertensive patients with IHD showed high levels of S. iron and S.ferritin and lower levels in TIBC. This study indicated that there was no association between body iron status and IHD.

RECOMMENDATIONS

1) Health education, diet control, and exercise are important factors in lowering body weight, especially in obese patients to achieve good control of ischemic heart disease.
2) There is a need to improve the patients with risk factors for IHD and the general population's awareness of IHD complications, and the importance of life style modifications. This could be achieved by improving patients' counseling by primary care physicians, or through campaigns and media to aware general populations.
3) More laboratory investigations should be done for ischemic heart disease patients related to the iron profile.
4) Increase sample size to perform accurate results.

FUNDING

There was no specific grant for this research from any funding agencies.

REFERENCES

1. Maton, A., Hopkins, J., McLaughlin, C. W., Johnson, S., Warner, M. Q., LaHart, D., & Wright, J. D. Human Biology and Health (1993). *Englewood Cliffs, New Jersey, US: Prentice Hall*.
2. Kelly, B. B., & Fuster, V. (Eds.). (2010). Promoting cardiovascular health in the developing world: a critical challenge to achieve global health.
3. Onow, R.O. (2012). Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine. 9th ed. Philadelphia, Pa.Saunders Elsevier.
4. Dantas, A. P., Jiménez-Altayó, F., & Vila, E. (2012). Vascular aging: facts and factors. *Frontiers in physiology*, *3*, 325.
5. Mathers, C. D., & Loncar, D. (2006). Projections of global mortality and burden of disease from 2002 to 2030. *PLoS medicine*, *3*(11), e442.
6. Peden, M., Scurfield, R., Sleet, D., Mathers, C., Jarawan, E., Hyder, A. A., & Jarawan, E. (2004). *World report on road traffic injury prevention*. World Health Organization.
7. Finegold, J. A., Asaria, P., & Francis, D. P. (2013). Mortality from ischaemic heart disease by country, region, and age: statistics from World Health Organisation and United Nations. *International Journal of cardiology*, *168*(2), 934-945.
8. Hung, M. J., & Cherng, W. J. (2003). Comparison of white blood cell counts in acute myocardial infarction patients with significant versus insignificant coronary artery disease. *American Journal of Cardiology*, *91*(11), 1339-1342.
9. Moran, A. E., Forouzanfar, M.H., Rotti, G.A., Mensah. (2010). The global burden of disease 2010 study, doi:10.1161/PMID24573352.
10. Mozaffarian, D., Roger, V.L., Benjamin, E.J., Berry. (2013). Heart disease and stroke statistics. A report from the American heart association. 2013dio:10.1161/pmc:5408511/pmid:23239837.
11. Mendis, S., Puska, P., Norrving, B. (2011). *Global Atlas on cardiovascular disease prevention and control*, ISBN 978-92-4-156437-3
12. Finks, S. W., Airee, A., Chow, S. L., Macaulay, T. E., Moranville, M. P., Rogers, K. C., & Trujillo, T. C. (2012). Key articles of dietary interventions that influence cardiovascular mortality. *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy*, *32*(4), e54-e87.
13. Yusuf, S., Hawken, S., Ounpuu, S. (2004). "Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the interheart study): case-control study".
14. Burtis, C.E., Ashwood, E., & Bruns, D.E. (2006). Tietz text book of clinical chemistry and molecular diagnosis. Fourth edition. United States of America. 1186, 1192.
15. Wong, N.D. (2014). "Epidemiological studies of CHD and the evolution of preventive cardiology. (May 2014)". Nature reviews. *Cardiology*, *11*(5); 276–89. Doi:10.1038/nrcardio.2014.26. PMID 24663092.
16. Das, De, S. (2015). Atherosclerosis 2015.http://www.ncbi.nlm>.nih.gov/pmc/ articles /pmc4063519.
17. Sunny Chopra Anju Huria Ashok Kumar Lal Meenakshi Dhar Journal of Cardiovascular Disease Research, *6*(1).
18. Salonen, J. T., Nyyssönen, K., Korpela, H., Tuomilehto, J., Seppänen, R., & Salonen, R. (1992). High stored iron levels are associated with excess risk of myocardial infarction in eastern Finnish men. *Circulation*, *86*(3), 803-811.
19. McCord, J.M. (1991). Is iron sufficiency a risk factor in ischemic heart disease? Circulation, *83*(3); 1112–4.