



Purposeful scientific research is a basic pillar for the advancement of Iraq



The Relationship of Homocysteine with HbA1C in Blood of Patients with Thalassemia in Wasit Governorate

Manar Mohammed Jassim, Arwa Soud Alwan

Salahuddin Education Directorate, Tikrit, Iraq

ABSTRACT

The study was carried out on (120) samples, (60) samples with thalassemia and (60) samples of a (healthy) control group, whose ages ranged between (15-30) years. The samples were collected from Al Karama Hospital in Wasit Governorate. The results of the study showed a significant increase at the probability level ($p < 0.05$) in the level of homocysteine and HbA1C at a rate of (164.1 ± 29.9) ng / ml and (9.50 ± 1.45) %, respectively, in the blood of patients with thalassemia compared with the healthy. Statistical results showed a negative correlation between homocysteine and HbA1C in thalassemia patients with a positive correlation value with a correlation coefficient value (0.278) between the homocysteine level and HbA1C in healthy subjects.

Keywords: Thalassemia, Homocysteine, HbA1c,

Introduction

Homocysteine is a non-essential sulfur amino acid produced as a natural intermediate during the metabolism of the amino acid methionine (1). Its benefit lies in the formation of the amino acid cysteine, which enters the composition of yeasts and hormones, such as the hormone insulin, which regulates the concentration of blood glucose, despite the presence of cysteine in the proteins that humans eat. (2) The interest in it increased after it was concluded that its high rate directly causes a number of different vascular diseases that children, young people and the elderly suffer from, including early death as a result of cardiovascular damage in the event that excess homocysteine in the liver and kidneys is not converted to methionine. Or stathionine and then cysteine, as it is excreted outside the cell into the blood, causing damage to the lining of the blood vessels and thus damage to the cells in the lining. Its concentration is above its normal level in the blood (1). The amino acid homocysteine has two metabolic pathways: remethylation to methionine, and this requires folic acid and vitamin B12, and the transfer of sulfate to cystathionine, which requires the presence of vitamin B6 (2). Homocysteine is a measure of health, as there is a correlation between the amount of homocysteine and the general health status of the patient, and the amount of homocysteine is a function of both healthy and unhealthy factors, including physical inactivity, smoking, drinking coffee, cholesterol, vitamins, and others.(3) Homocysteine exists in different forms, namely homocysteine. Protein-bound: - which

represents the main form of homocysteine, as it is often bound to albumin, and it constitutes about (90-80)% of the total homocysteine, and the other oxidized forms constitute about (10-5)% of the total homocysteine, and free homocysteine or the so-called reduced homocysteine. It constitutes about 1% of the amount of homocysteine in the plasma. The total homocysteine represents the sum of the three types above (1). Glucose binds with many proteins by a process known as protein glycosylation, as hemoglobin is one of these proteins, and it was called by several names, including glycohemoglobin and glycosylated hemoglobin. Complications of diabetes as well as a risk factor for vascular disease. HbA1c is formed by binding hemoglobin to blood glucose in a non-enzymatic manner. This binding is slow under physiological conditions and depends on the amount of glucose in the blood, and the increased amounts of HbA1c are found in the red blood cells (RBC) of diabetic patients as a result of their high ability to bind in the case of high levels of glucose. Glucose occurs inside red blood cells within 90-120 days of the red cell's life, and the percentage of glucose hemoglobin can be an important indicator of clot dissolving after acute stroke (4). The research aims to know the level of homocysteine and HbA1c in the blood of people with thalassemia and to find a relationship between them.

Materials and Methods

120 samples were collected and their ages ranged between (30-15) years, (60) samples infected with Thalassemia and (60) healthy samples as a control

group. Samples were collected from Al-Karama Hospital in Wasit Governorate. About (5) ml of blood was taken from healthy and sick people and divided according to the type of test, where (2.5) ml of blood was placed in Jell tubes with a tight cover and free of anticoagulant, and the blood was left at a temperature of (25) C until it clotted and then It was placed in a centrifuge for (10) minutes at a speed of (3000 cycles / minute), after which the homocysteine was estimated. As for the other part of the blood, it was placed in other tubes, and the HbA1c tests were performed on it.

Estimation of glycolytic hemoglobin / a diagnostic kit supplied by the American company Stan Bio was used (5).

Estimation of the level of homocysteine / the level of homocysteine was estimated according to the diagnostic kit supplied by the American company Elabscience and according to the method of the researcher (6) statistical analysis / the results of all tests were analyzed using the statistical program SPSS14, to determine the mean and standard deviation of the mean (SD), and the special differences between groups of patients and the control group were determined using T.Test. (7)

Results and discussion

Table (1) shows the average $\pm$ standard deviation of the homocysteine level, as the results showed a significant increase at the probability level of $p \leq 0.01$ in the level of homocysteine in the blood of thalassemia patients compared with the healthy controls.

Table 1: Mean $\pm$ standard deviation of homocysteine level in thalassemia patients compared with healthy controls

Mean $\pm$ S.D (mmol/L)	Studied Variables
P $\leq$	
Patients (n=60)	Control (n=60)
0.01	29.9 $\pm$ 164.1
	4.38 $\pm$ 47.89
	Homocysteine

When comparing the level of homocysteine between males and females, the results showed that the average level of homocysteine in male patients was (168.9 $\pm$ 35.4 mmol / liter) compared to the average level with the healthy group (47.74 $\pm$ 4.51) mmol / liter for the healthy group, while it was in the blood of infected females (158.7 $\pm$ 22.0 mmol/L compared to (49.67 $\pm$ 1.53) mmol/L for the healthy female group, as shown in Figure (1).

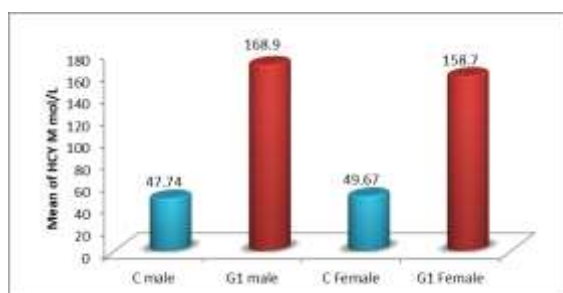


Fig. 1: The level of homocysteine in the blood serum of thalassemia patients compared to healthy controls by sex

When comparing the level of homocysteine between the age groups, the results showed that the mean $\pm$ standard deviation of homocysteine in the blood of the age group (20-15), (25-21), (30-26) was (47.455 $\pm$ 2.622), (46.31 $\pm$ 5.38), (50.192 $\pm$ 3.364) mmol / L, respectively, for the healthy group, while the patients were (158.98 $\pm$ 23.15), (172.69 $\pm$ 39.54), (156.47 $\pm$ 7.11) mmol / L, respectively, shown in Figure (2).

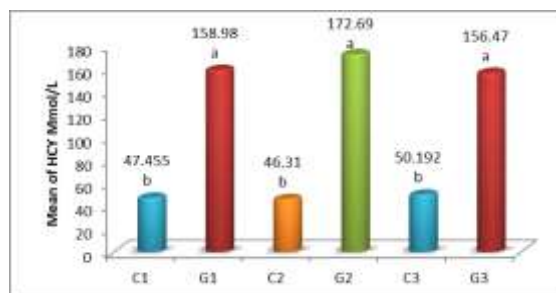


Fig. 2: The level of homocysteine in the blood of thalassemia patients compared to healthy subjects according to age groups

(Talat., 2010) indicated that there was a significant increase in homocysteine in patients with beta thalassemia compared to healthy people, as it was found in his study that there is a positive relationship between homocysteine and malondialdehyde, as the increase in homocysteine leads to oxidative stress. (8) The reason for the high level of homocysteine is explained by genetic factors that cause a deficiency of some enzymes that play an important role in the metabolism of homocysteine, folate or vitamin B12. This leads to a slowdown in the conversion of homocysteine to cysteine, and this leads to the accumulation of homocysteine and an increase in its level in the blood (10). Homocysteine is affected by several factors that contribute to its rise, including age, gender, improper lifestyle factors, neuropathy, smoking, obesity, and excessive eating that contains a high percentage of sugar. Fat or as a result of some diseases (9).

Table 2: Mean $\pm$ standard deviation of HbA1c in Thalassemia patients compared to healthy controls

Mean $\pm$ S.D (%)	Studied Variables
P $\leq$	
Patients (n=60)	Control (n=60)
0.01	1.45 $\pm$ 9.50
	0.749 $\pm$ 6.225
	HbA1C

When comparing the results of the study statistically by sex, the significant increase in HbA1C was found, as it reached (9.56 $\pm$ 1.53) (6.169 $\pm$ 0.747) for sick and healthy males, respectively, while for females, its level was (9.45 $\pm$ 1.40) compared to (6.387 $\pm$ 0.75) for patients and statistics Respectively, it was found that there were no significant differences between both sexes, patients and healthy ones, as shown in Figure (2).

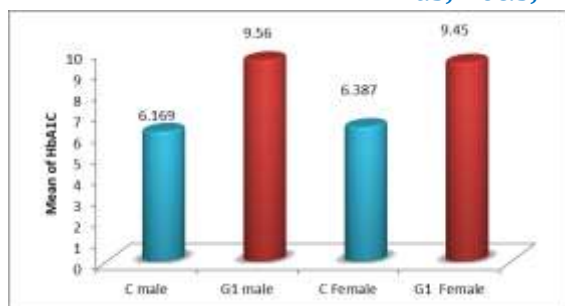


Fig. 3: The level of HbA1C in the blood of thalassemia patients compared to healthy subjects by sex

When comparing the level of HbA1C according to age groups, the results showed that the average $\pm$ standard deviation of its level in the blood of the age group (20-15), (25-21), (30-26) was (6.170 ± 0.792), (6.192 ± 0.649), (6.337 ± 0.871), respectively, for the group of healthy people. As for the patients, it was (9.730 ± 1.520) (9.385 ± 1.493) (8.983 ± 0.637), respectively, according to what is shown in Figure (3), as the results showed a significant increase among all groups. Sick compared to healthy people.

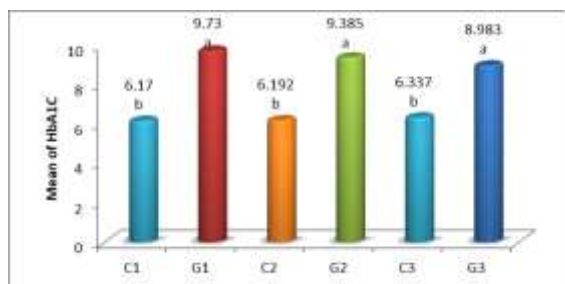


Fig. 4: The level of HbA1c in the blood of thalassemia patients compared to healthy controls by age groups

The rise in HbA1c may be explained by the fact that the hemoglobin that contains sugar is formed from the binding of sugar to hemoglobin type A. If the sugar percentage or its level is high in the blood, it will make the hemoglobin linked to sugar high as well (11) and age can also have an effect on HbA1c, as There is a positive significant relationship between age and HbA1c (12).

References

1. Djap, H. S.; Sutrisna, B.; Soewondo, P.; Djuwita, R.; Timotius, K.(2018) "Waist to height ratio (0.5) as a predictor for prediabetes and type 2 diabetes in Indonesia" Mater. Sci. Eng. 434(01).
2. Karalis, D.G. (2009)"Intensive. Lowering of low-density lipoprotein cholesterol levels for primary prevention of coroner artery disease", mayoclinproc, 84,4: 342-45. rafting in Diabetic patients. : Trial. Jam Coll Cardiol ; 55: 432 – 40.
3. Harald, K. (2017)." Risk of incident myocardial infarction by gender: Interactions with serum lipids, blood pressure and smoking ", Atherosclerosis, 261,p :52–59.
4. Gupta, S.; Chauhan, N.; Jain, U. (2017)" Laboratory Diagnosis of HbA1c: A Review" J Nanomed Res 5(4).
5. Moriwaki, Y.; Yamamoto, T; Shibutani, Y; Harano, T; Takahashi, S and Hada T. (2000) "Abnormal haemoglobins, Hb Takamatsu and Hb G-Szuhu, detected during the analysis of glycated haemoglobin (HbA_{1c}) by high performance liquid chromatography" J Clin Pathol. November; 53(11): 854–857.
6. Hartl. D.L. and. Jones. E.W. (2002) "Genetics analysis of genes and genomes" S th ed. Jones and Bartletl publishers. U.S.A.
7. James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). An introduction to statistical learning (Vol. 112, p. 18). New York: springer.
8. Talat. T.K. (2010)" Estimation of malondialdehyde leve; s and the relationship with

The results showed that the relationship is positive between the level of homocysteine and HbA1c in the blood of healthy people, as the value of the correlation coefficient was ($r = 0.278$), which is illustrated by Figure (4), while the relationship in thalassemia patients was a weak negative relationship with the value of the correlation coefficient ($r = -0.005$)., as shown in Figure (5), and these results are in agreement with the findings of Chen and his group (2013) (13) and other studies.

Thalassemia patients suffer from hyperhomocysteinemia due to the low level of folic acid, and it rises to high levels when it is stopped as a dietary supplement to patients (14). High levels of hyperhomocysteinemia are associated with advancing age, low folic acid and vitamin B12, and kidney dysfunction in addition to malnutrition (13) and this may be a complication of thalassemia.

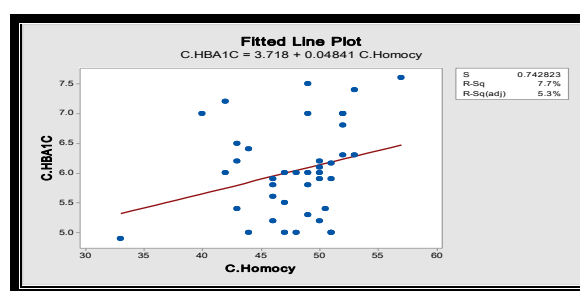


Fig. 5: The correlation between homocysteine and HbA1c in healthy people blood

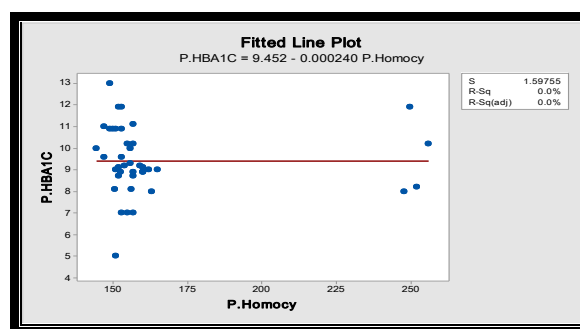


Fig. 6: The correlation between homocysteine and HbA1c in the blood of thalassemia patients

- homocysten and serum copper in beta-thalassemia patients". Kufa Med. Journal. 13 (1).
9. Fu, Y.; Wang, X. and Kong, W. (2018)" Hyperhomocysteinaemia and vascular injury: advances in mechanisms and drug targets" British Journal of pharmacology, 175: 1173–1189.
10. Vinukonda G, Plasma Homocystein and methylenetetrahydrofolate reductase gene polymorphism in human health and disease *Int J hum genet*, 2008; 8(12):171-179.
11. Mogensen EF; Larsen L; N. *Engl. J. Med* 1990. Effect of long-term monitoring of glycosylated hemoglobin levels in insulin –dependent diabetes mellitus. 323:5-1021.
12. A.P. Yates and I. Laing. (2002). Age-related increase in haemoglobin A1C and fasting plasma glucose is accompanied by decrease in b-cell function without change in insulin sensitivity. *Volum 19*, P254 -258.
13. Chen, S.; Cui, C.; Wu, P. and Xie, N (2013) "Relationship of serum homocysteine level with nutritional status and HbA1c level in elderly inpatients" *Int J Clin Exp Med*. 2013; 6(9): 779–784.
14. Baghersalimi, A.; Hemmati Kolachahi, H.; Darbandi, B.; Kamran Mavardiani, Z.; Alizadeh Alinodhi, M. (2018) "Assessment of Serum Folic Acid and Homocysteine in Thalassemia Major Patients Before and After Folic Acid Supplement Cessation" *J Pediatr Hematol Oncol*, 40 (7):504-507.