Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.47750/jptcp.2023.30.04.049

Study the Dynamic Thiol -Disulfide Homeostasis in patients with Diabetes type I and type 2

Zainab M.Qassam[1]*, Ekhlass M. Taha[2]
[1,2]University of Baghdad College of Science for women Department Chemistry , Al-Jadriya Baghdad Iraq
***Corresponding author:** Zainab M.Qassam, University of Baghdad College of Science for women Department Chemistry , Al-Jadriya Baghdad Iraq, Email: iklasmb_chem@csw.uobaghdad.edu.iq

Submitted: 29 January 2023; Accepted: 20 February 2023; Published: 26 March 2023

ABSTRACT

Background: Diabetes is a condition in which the levels of blood glucose are abnormally high (also known as blood sugar). Diabetes mellitus is a rapidly expanding global problem with significant social, health, and economic implications.

Methodology: 144 volunteers were enrolled in the current study, The volunteers were divided into four groups: the first group consist of 21 subjects with control type 1, the second group consist of 51 patients with type 1, the third group consist of 20 subjects with control type 2, and the fourth group consists of 55 subjects with patients type 2. Total thiol, Native thiol, F.B.S, and Total protein concentrations were determined using an absorbance spectrophotometer.Hba1c concentration was determined using an i-chroma.

Results: The result of Total thiol, Native thiol ,Dynamic thiol-disulfide, and Total protein thiol showed a non -significant change between the fourth groups. The level of serum Hba1c and F.B.S showed a significant change among fourth groups.

Conclusion: Total thiol, Native thiol, Dynamic thiol-disulfide, and Total protein do not effect by Diabetes type 1and type 2.

Keywords: *Dynamic Thiol, Native thiol, Diabetes , protein*

INTRODUCTION

Diabetes mellitus (DM) has been one of the main causes of death worldwide in the last century, becoming increasingly pressing in the last few decades with the exponential development of obesity (1). Also, Diabetes mellitus (DM) is one of the most common causes of chronic kidney disease (CKD), which results in insulin resistance and reduced insulin breakdown (2). Diabetes Type 1 is the type that occurs in children of a young age, As a result of lack of insulin. Where the cell of the pancreas (β-cell) are unable to secrete insulin. (3).

Diabetes Type 2 or called insulin resistance, in this type, the pancreas secretes insulin, but it does not function properly due to insulin resistance. For proteasomal degradation and common physiological activities, it mediates the ubiquitylation of certain protein substrates such as cyclin E, Notch, mammalian Target Of Rapamycin (mTOR), and c-Myc (4)(5). In prediabetes, insulin resistance and decreased beta-cell activity are frequently present. Hyperglycemia can enhance the production of reactive oxygen species (ROS) and so promote

vascular dysfunction by upregulating indicators of chronic inflammation. Diabetes mellitus is a worldwide epidemic that is causing worry. Diabetes causes an excess generation of free radicals due to chronic hyperglycemia (6). Thiols are a type of chemical molecule that contains a sulfhydryl group (-SH). They are made up of a carbon atom, a hydrogen atom, and a sulfur atom. Excess electrons pass to thiols and disulphide bonds are produced in the organism as a result of the oxidation caused by ROS. Electrons in these reversible bonds can return to thiols due to the oxidative balance. Enzymatic reactions, signal transduction, detoxification, transcription, modulation of enzymatic activity, cellular signaling mechanisms, and apoptotic reaction all benefit from thiol-disulphide homeostasis' antioxidant capabilities (7).

MATERIALS AND METHODS

The study was conducted in the Biochemistry lab for the period from December 2020 and January 2021, Patients' consent and ethical approval from the relevant institutional review board are required.One hundred Forty four people were registered in this research study from the Al-Batool Teaching Hospital in Iraq between December 2020 and January 2021. The subjects were divided into four groups: the first had 21 subjects with control type 1, the second had 51 patients with type 1, the third had 20 subjects with control type 2, and the fourth had 55 subjects with patients type 2. Total thiol, Native thiol, FBS, and Total protein concentrations were determined using an absorbance spectrophotometer. Hba1c concentration was determined using an i-chroma.

Statistical analysis

The statistical analysis tool was used to analyze the data (SPSS 25). For non-parametric distributed data, the Mann Whitney test and the Superman test were employed to analyze the data at the 0.05 level of significance. For normal parametric distribution data, the Student T-test with 0.05 alpha level was used.

RESULT AND DISCUSSION

The Age and BMI results were matched between healthy and patient in the current study Table 1.

TABLE 1: Distribution of mean age and BMI for type 1 patients group and control **.**

Group Parameter s	Type 1	Control	P value
Age	11.94 ± 2.16	12.1 ± 2.04	0.626
BMI	26.76 ± 10.08	28.46 ± 7.48	0.517

*Significant using in dependent T- Test at 0.05 level.

Type 1 age was distributed between 7 years to 16 years, mean ± SE of age for both the studied groups [patients with type 1 diabetes and normal persons] were (11.94 ± 2.16712) and (12.1 ± 2.04695) respectively.BMI distribution was variable between groups with no significant levels, mean ± SE of BMI for both the studied groups [patients with type 1 diabetes and normal persons] (26.7652 ± 10.08154) and (28.4693 ± 7.48044) respectively.

Type 2 data are presented in table (2), Age and BMI were varied in their distribution with significant difference.

TABLE 2: Data Distribution of the type 2 diabetes Patients and control Group.

Group Parameters	Type 2	control	P value
Age	55.43 ± 15.11	46.9 ± 15.48	0.03
BMI	25.12 ± 3.08	20.09 ± 5.04	0.00

*Significant using in dependent T- Test at 0.05 level.

Type 2 age was distributed between 25 years to 75 years, mean ± SE of age for both the studied groups [patients with type 2 diabetes and normal persons](55.4364 ± 15.11164) and(46.9 ± 15.4848) respectively. The mean ± SE of BMI for both the studied groups [patients with type 2 diabetes and normal persons] (25.125 ± 3.08354) and (20.0942 ± 5.04861) respectively, where the result indicates no significant differences between groups .

This result in some way agrees with Marwan M. Merkhan et. al. (8), and Kameran Hassan et. al.(9). They have shown that there is no significant difference between age of controls and patients with T1DM and T2DM. Age is one of the main risk factors in prediabetes and type2 diabetes incidence (10). It is well known that T2DM is often undiagnosed for many years because hyperglycemia slowly progresses and is often not sufficiently severe at earlier stages for the patient to notice the symptoms of classic diabetes. The results can be clarified on the ground that, with age, obesity and lack of physical activity, the risk of developing type2 diabetes rises (11), Whereas type 1 diabetes not affected with the presented factors.

Table (3) shows the means rank of parameters for Groups of type 1 diabetes Patients and control. The results referred to present the data statistically without any significant differences ($p>0.05$) in Total thiol (mmol/l), native thiol (mmol/l), dynamic thiol and total protein in group of the type 1 diabetes compare with control group.

TABLE 3: The mean rank of parameters for type 1 diabetes Patients and control group.

Groups	Parameters	Median(min-max)	Mean Rank	P-Value
Type1 Patients	Total thiol (mmol/l)	1.0 (0.78-1.3)	38.7	0.1
	Native thiol (mmol/l)	0.78 (0.2-1.23)	38.2	0.06
	Dynamic thiol	0.66 (0.52- 0.81)	38.4	0.8
	Total Protein	6.2 (4-8.9)	36.1	0.5
Control type 1	Total thiol (mmol/l)	1.03 (0.98- 1.09)	39.5	0.1
	Native thiol (mmol/l)	0.70 (0.48- 1.0)	40.8	0.06
	Dynamic thiol	0.68 (053-0.79).	40.3	0.8
	Total Protein	6.1 (4.9 – 7.5)	33.7	0.5

TABLE 4: The Mean ± SE of F.B.S and HbA1c, in patients with type 1 diabetic and control subjects.

	Group	Mean ± SE	P- value
F.B.S	type 1	181.8947 ± 10.78578	0.00
	control type 1	98.3913 ± 2.36972	
HbA1c	type 1	9.5105 ± .30141	0.00
	control type 1	4.5565 ± .09489	

* Significant using T-TEST at 0.05 level.

The mean ± SE of serum F. B.S. levels in Typ1 diabetic, and control type 1 are shown in Table (4). Group of type 1 diabetes Patients showed a significant increase ($p<0.01$) when compared with control group .

The results of HbAIC mean ±SE in type 1 diabetes Patients and control Group [(9.5105 ± 0.30141) and (4.5565± 0.9489)] respectively, where the result indicates significant change between groups in HbAIC ($P<0.05$) .

In the current study, high levels of HbA1c are due to poor glycemic control in diabetic.

HbA1c provides a reliable measure of chronic glycemia and correlates well with the risk of long-term diabetes complications, so that it is currently considered the test of choice for monitoring and chronic management of diabetes. Among diabetics, the blood glucose levels increase in the blood and the glucose attaches to the hemoglobin molecule in a concentration-dependent manner. The glucose-bound (glycated) hemoglobin or HbA1c provides the average glucose levels in an individual's blood as it becomes glycated with the hemoglobin. It is important to note that the HbA1c levels are directly proportional to the blood glucose levels (12).

Table (5) shows the means rank of parameters for Groups of type 2 diabetes Patients and control. The results presented statistically without any significant differences ($p>0.05$) in Total thiol (mmol/l), native thiol (mmol/l), dynamic thiol and total protein in group of the type 2 diabetes compare with control group.

TABLE 5: The mean rank of parameters for the type 2 diabetes Patients and control Group.

Groups	Parameters	Median (min-max)	Mean Rank	P-Value
Type 2 Patients	Total thiol (mmol/l)	1.0 (0.95-1.0)	38.2	0.1
	Native thiol (mmol/l)	0.75 (0.57-1.07)	37.5	0.6
	Dynamic thiol	0.66 (0.54 – 0.76)	40.7	0.8
	Total protein	5.6 (4.7-7.5)	36.7	0.5
Control type 2	Total thiol (mmol/l)	1.06(0.93- 1.09)	46.4	0.1
	Native thiol (mmol/l)	0.84 (0.73- 1.04	48.2	0.6
	Dynamic thiol	0.6 (0.52 – 0.71	39.7	0.8
	Total protein	5.8 (4.7-6.2)	33.5	0.5

TABLE 6: The Mean ± SE of F.B.S and HbA1c, in patients with type 2 diabetic and control subjects.

	Group	Mean ± SE	P- value
F.B.S	type 2	209.1864 ± 11.21519	0.00
	control type 2	114.2432 ± 1.90400	
HbA1c	type 2	8.6458 ± 0.29790	0.00
	control type 2	5.0622 ± 0.04814	

* Significant using T-TEST at 0.05 level.

The mean ± SE of serum F.B.S levels in all studied groups are shown in Table (5). Group of type 2 diabetes Patients showed a significant increase ($p<0.01$) when compared with control group.

The results of HbAIC mean ±SE in type 2 diabetes Patients and control Group were [(8.6458± 0.29790) and (5.0622± 0.04814)] respectively, where the result indicates significant change between groups in HbAIC ($P<0.05$).

This result agreement with Sherwani et al., (2016) whom said the nondiabetes usually falls within the 4.0%–5.6% HbA1c range. The prediabetes usually has the HbA1c levels as 5.7%–6.4%, while those with 6.4% or higher HbA1c levels have diabetes.12,28 Since diabetes is associated with several comorbidities, the recommendations for individuals with diabetes include a healthy lifestyle (diet and exercise) and maintaining the HbA1c levels below 7.0%. Diabetes-related complications are directly proportional to the levels of HbA1c – the increase in the HbA1c levels also increases the risk of such complications (13).

TABLE 7: The distribution of studied parameter in patients diabetes type I group shows correlation between HbA1c and Native thiol. Also, the results shows a correlation between Total thiol and Native thiol. Also there is correlation between Native thiol and dynamic thiol /disulfide .

Parameters	Duration	F.B.S	HbA1c	Total thiol	Native thiol	Dynamic thiol	Total protein
Duration	1.000	0.072	-0.075	0.103	0.085	-0.057	-0.052
F.B.S		1.000	0.033	-0.036	-0.208	0.255	-0.054
HbA1c			1.000	-0.053	-0.365*	0.243	-0.157
Total thiol				1.000	0.439*	0.185	0.120
Native thiol					1.000	-0.699**	0.173
Dynamic thiol						1.000	0.067
Total protein							1.000

TABLE 8: The distribution of studied parameter in control diabetes type I group shows correlation between F.B.S and HbA1c, Total protein. Also , the results shows a correlation between HbA1c and Total protein. Also the result shows Native thiol and dynamic thiol /disulfide

Parameters	Duration	F.B.S	HbA1c	Total thiol	Native thiol	Dynamic thiol	Total protein
Duration	.	.	.	.	.	.	.
F.B.S		1.000	0.584**	-0.172	-0.180	-0.133	0.503*
HbA1c			1.000	0.115	-0.372	0.335	0.550*
Total thiol				1.000	0.293	0.376	0.128
Native thiol					1.000	-0.505*	-0.053
Dynamic thiol						1.000	0.162
Total protein							1.000

TABLE 9: The distribution of studied parameter in patients diabetes type II group shows correlation between F.B.S and HbA1c,Total thiol, dynamic thiol/disulfide. Also, the results shows a correlation between HbA1c and Total thiol. Also there is correlation between Total thiol and dynamic thiol /disulfide and the results show a correlation between Native thiol and dynamic thiol /disulfide.

Parameters	Duration	F.B.S	HbA1C	Total thiol	Native thiol	Dynamic thiol	Total protein
Duration	1.000	-0.009	-0.077	0.061	-0.044	0.025	0.194
F.B.S		1.000	0.701**	-0.290*	0.201	-0.274	-0.029

HbA1c			1.000	-0.31*	-0.030	-0.041	0.006
Total thiol				1.000	0.074	0.259*	-0.058
Native thiol					1.000	-0.860**	0.008
Dynamic thiol						1.000	-0.051
Total protein							1.000

TABLE 10: The distribution of studied parameter in control diabetes type II group shows correlation between F.B.S and HbA1c, Total thiol .Also there is correlation between Total thiol and dynamic thiol/disulfide and the results show a correlation between Native thiol and Total protein.

Parameters	F.B.S	HbA1c	Total thiol	Native Thiol	Dynamic thiol	Total protein
F.B.S	1.000	0.893***	0.490*	0.156	0.370	0.185
HbA1c		1.000	0.314	-0.028	0.280	0.075
Total thiol			1.000	0.306	0.720**	0.337
Native thiol				1.000	-0.320	0.512*
Dynamic thiol					1.000	-0.179
Total protein						1.000

CONCLUSION

Total thiol (mmol/l), native thiol (mmol/l), dynamic thiol, and total protein reveal not appeared -significant between healthy persons and diabetic patients type 1, as well as between healthy persons and diabetic patients type 2.

REFERENCE

1. Glovaci D, Fan W, Wong ND. Epidemiology of diabetes mellitus and cardiovascular disease. Current cardiology reports. 2019 Apr;21(4):1-8.
2. Rajput R, Sinha B, Majumdar S, Shunmugavelu M, Bajaj S. Consensus statement on insulin therapy in chronic kidney disease. Diabetes research and clinical practice. 2017 May 1;127:10-20.
3. Nelson DL, Lehninger AL, Cox MM. Lehninger principles of biochemistry. Macmillan; 2008.
4. Zhao X, Hirota T, Han X, Cho H, Chong LW, Lamia K, et al. Circadian amplitude regulation via FBXW7-targeted REV-ERBα degradation. Cell. 2016Jun;165:1644–57.
5. Kourtis N, Moubarak RS, Aranda-Orgilles B, Lui K, Aydin IT, Trimarchi T, et al. FBXW7 modulates cellular stress response and metastatic potential through HSF1 post-translational modification. Nat Cell Biol. 2015;17:322–32.
6. Lee WC, Mokhtar SS, Munisamy S, Yahaya S, Rasool AH. Vitamin D status and oxidative stress in diabetes mellitus. Cellular and Molecular Biology. 2018 May 30;64(7):60-9.
7. Kükürt A, Gelen V, Başer ÖF, Deveci HA, Karapehlivan M. Thiols: Role in oxidative stress-related disorders. InLipid Peroxidation 2021 Mar 20. IntechOpen
8. Wang Z, Yu C, Wang J, Bao J, Gao X, Xiang H. Age-period-cohort analysis of suicide mortality by gender among white and black Americans, 1983–2012. International journal for equity in health. 2016 Dec;15(1):1-9.
9. Wang S, Ding L, Ji H, Xu Z, Liu Q, Zheng Y. The role of p38 MAPK in the development of diabetic cardiomyopathy. International journal of molecular sciences. 2016 Jul;17(7):1037.
10. Mordarska K, Godziejewska-Zawada M. Diabetes in the elderly. Przeglad menopauzalny= Menopause review. 2017 Jun;16(2):38.
11. Al-Attaby AK, Al-Lami MQ. Effect of age and gender on some biochemical, hormones and adipocytokines parameters in Iraq type 2 diabetes mellitus patients. Int. Res. J. Pharm.2018;9(12).

12. Haglund, A.C.; Ek, B.; Ek, P. Phosphorylation of human plasma _2-Heremans-Schmid glycoprotein (human fetuin) in vivo. Biochem. J. 2001, 357, 437–445.

13. Lima VC, Cavalieri GC, Lima MC, Nazario NO, Lima GC. Risk factors for diabetic retinopathy: a case–control study. International journal of retina and vitreous. 2016 Dec;2(1):1-7.

J Popul Ther Clin Pharmacol Vol 30(4):e500–e506; 26 March 2023.