

The Effect of Aspirin on HbA1c Assay Among Diabetic Hypertensive Patients Attending Abu Aqulah Centre in Wad Madani, Gezira State, Sudan

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Abstract: *Background and Objective:* Diabetes is one of the most common diseases in the world, and its prevalence has increased dramatically in the last century until it reached approximately 422 million in the world. The increase in disease has lead to a decrease in production and an increase in financial costs for patients, several methods were taken to diagnose diabetes millets such as glucose tolerance and fasting glucose measurement until the Ministry of World Health approved in 2011 that hemoglobin A1c is suitable for diagnosing and controlling diabetes. But some studies indicated Hemoglobin A1c is affected by aspirin and other factors that can give false results and affect diagnosis or monitoring. So this Cross-Sectional study was conducted and the aim to study the effect of aspirin on hemoglobin A1c among diabetic hypertensive, to determine the effect of aspirin, age, sex and fasting glucose on HbA1c concentration. *Materials and Methods:* ichroma was used for measuring HbA1c and colorimeter for measuring fasting blood glucose. Questionnaire for age and sex, the venous sample were collected in (EDTA) Ethlyine Di amin tetra acetic acid for HbA1c measuring and fluoride oxalate for fasting measuring. The study was done at Wad Madni and included 100 patients with diabetes and hypertension, 50 of them used aspirin, while the other 50 did not use aspirin. *Results:* The result of the study was increased in HbA1c in patient use aspirin more than 2 years HbA1c mean was (9.7) and less in patient use aspirin less than 2 years HbA1c mean (9.4), p value (0.048). The comparison between male and female the HbA1c was more in female (10.6) than male (9.2), p value (0.045) also HbA1c associated with BMI and fasting glucose. The statistically package for social studies (SPSS) version 20 programs was used for the analysis of data. Relative risk and odd ratio also should be calculated was used for statistical analysis. *Conclusion:* The level of HbA1c is increase with aspirin using and associated with fasting blood glucose and BMI. And female have high level of HbA1c than male. The age of patient not effect on HbA1c level.

Keywords: Diabetes Mellitus, Hypertension, HbA1c, Fasting Glucose, Aspirin

1. Introduction

Hemoglobin A1c (HbA1c) is define by the International Federation of Clinical Chemistry working group (IFCC) as hemoglobin that is irreversibly glycated at one or both N terminal valines of beta chains, it is formed from irreversible,

slow non enzymatic addition of sugar residue to hemoglobin and the rate of production is directly proportional to ambient glucose concentration [1].

Analysis of glycated hemoglobin (HbA1c) in blood provides evidence about an individual's average blood glucose levels during the previous two to three months, which is the predicted half-life of Red blood cells (RBCs) [2].

In the normal 120-days life span of the red blood cell glucose molecules join hemoglobin, forming glycosylated hemoglobin. In individuals with poorly controlled diabetes, increases in the quantities of this glycosylated hemoglobin are noted. Once a hemoglobin molecule is glycosylated, it remains that way. A buildup of glycosylated hemoglobin within the red cell reflects the average level of glucose to which the cell has been exposed during its life cycle. Measuring glycosylated hemoglobin assesses the effectiveness of therapy by monitoring long term serum glucose regulation [3]. The HbA1c level is proportional to average blood glucose concentration over the previous four weeks to three months (some researches state that the major proportion of its value is related to a rather short term period of two to four weeks). Hemoglobin is the oxygen-carrying pigment that gives blood its red color and also the predominant protein in red blood cells. About 90% of hemoglobin is hemoglobin A. (The "A" stands for adult type.) Although one chemical component accounts for 92% of hemoglobin A, approximately 8% of hemoglobin A is made up of minor components that are chemically slightly different. These minor components include hemoglobin A1c, A1b, A1a1, and A1a2 [3]. Hemoglobin A1c (HbA1c) is a minor component of hemoglobin to which glucose is bound. HbA1c also is referred to as glycosylated or glucosylated hemoglobin. HbA1c levels depend on the blood glucose concentration. That is, the higher glucose concentration in blood, that is the higher level of HbA1c and not influenced by daily fluctuations in the blood glucose concentration but reflect the average glucose levels over the prior six to eight weeks. Therefore, HbA1c is a useful indicator of how well the blood glucose level has been controlled in the recent past and may be used to monitor the effects of diet, exercise and drug therapy on blood glucose in diabetic patients [3]. Diabetes mellitus has assumed epidemic proportion world wide on account of the various complications the development of the chronic causing much morbidity and mortality on account of its various complication the development of chronic vascular complication of diabetes such as retinopathy nephropathy and cardiovascular disease [4].

HbA1c, a measure of blood glucose regulation, reflects glucose levels in the preceding months. In diabetes, HbA1c levels predict the risk of microvascular complications [5].

The prevalence of diabetes in population and type 2 diabetes is particular, has reached epidemic proportions worldwide. The HbA1c test is currently one of the best ways to diagnose diabetes. Measurement of glycated hemoglobin is recommended for both checking blood sugar control in people who might be pre-diabetic and monitoring blood sugar control in patients with more elevated levels, termed diabetes mellitus. Measurement of HbA1c is an estimation of long term average glycemia, which assists diabetics as well as their physicians by providing treatment goals to reduce the risks associated with the development and progression of chronic complications of diabetes. Studies have shown that A1C is an index of average blood glucose over the preceding

few weeks to months. HbA1c truly does not reflect glycemic control as claimed. There are many factors that cause variation in A1C results. Factors affecting measurement of HbA1c like erythrocyte turnover rate, alcoholism, use of certain drugs in treatment of malignancies, human immunodeficiency virus or hepatitis C virus infection are known provide false results. Haemoglobin variants are formed by single base pair mutations in the globin genes of hemoglobin, resulting in an amino acid substitution. There are over 700 silent variants of which most of them interfere with HbA1c [4]. HbA1c measures the amount of glucose in the blood in the previous 2–3 months and is used to test whether an individual has diabetes ($\text{HbA1c} \geq 6.5\%$) [6]. A variety of HbA1c detection methods, including chromatography, immunoassay [7]. HbA1c can be used as a diagnostic test for diabetes [8]. Also, HbA1c levels are important for therapeutic adjustment and to predict the risk of developing chronic diabetic complications [9]. So this Cross-Sectional study was conducted and the aim to study the effect of aspirin on hemoglobin A1c among diabetic hypertensive, to determine the effect of aspirin, age, sex and fasting glucose on HbA1c concentration.

2. Materials and Methods

The study design was Cross-Sectional Study. The study was conducted in Wad Madani state at Abu Aqlah Health Center for Diabetes, during the period from April to August 2021. The study populations all are known diabetic hypertensive patients which is divided into two groups, case and control group. The case group using aspirin drug (group one) and the control group not using aspirin drug (group two). The sample size included in this study is 100 samples, 50 samples from diabetic hypertensive patients using aspirin and the rest (50) of the samples from diabetic hypertensive patients not using aspirin, including both male and female for different age and duration of aspirin use. The personal data obtained by questionnaire. Anticoagulated blood using ethylene diamine tetra acetic acid was used for determination of HbA1c and florid oxalate tubes for fasting blood sugar, the HbA1c and fasting blood glucose is measured by ichroma and colorimeter respectively. The obtained results is analyzed by the use of SPSS version 20.

2.1. Study Area

The study was conducted in Wad Madani state at Abu Aqlah Health Center for Diabetes.

2.2. Sample Size

The study was included one hundred samples, 50 diabetic hypertensive taking aspirin and 50 diabetic hypertensive not taking aspirin.

2.3. Study Population

All are known diabetic hypertensive patients using aspirin drug as case group (group one) and diabetic hypertensive

patient not using aspirin drug as control group (group tow).

2.4. Inclusion Criteria

Diabetic and hypertensive recruited in this study using a designed questionnaire.

2.5. Exclusion Criteria

Patients using any food affect in HbA1c estimation or drug like (Dapson and Vitamin D, E).

2.6. Data Collection

Personal data obtained by questionnaire design for the study.

2.7. Blood Sample Collection

Anticoagulated blood using ethylene diamine tetra acetic acid was used for determination of HbA1c and florid oxalate tubes for fasting blood sugar.

2.8. Calculation of BMI

BMI = kg/m^2 (where kg is a person's weight in kilograms and m^2 is their height in meters squared).

2.9. Data Analysis

Statistically package for social studies (SPSS) version 20 programs was used for the analysis of data. Relative risk and odd ratio also should be calculated was used for statistical analysis.

2.10. Ethical Consideration

The research approved and received ethical clearance from

the Health Research Committee in the ministry of health at Gezira State and informed consent was obtained from the participant patient.

3. Results

Table 1. The Gender of the diabetic hypertensive.

Gender	Frequency	Percentage
Male	50	50%
Female	50	50%
Total	100	100%

This table show the number of male and female were equal in this study.

Table 2. Distribution of the diabetic hypertensive according to age.

Age	Frequency	Percentage
40 – 50	18	18%
51 – 60	38	38%
61 – 70	35	35%
More than 70	9	9%
Total	100	100%

In this study most diabetic hypertensive were accumulate in age range 51 -70 years old.

Especially in range 51 -60 it form (30%).

Table 3. Distribution of diabetic hypertensive according to the aspirin duration.

Aspirin duration	Frequency	Percentage
Less than 2 years	12	42%
More than 2 years	38	58%
Total	50	100%

These tables show most of diabetic hypertensive in this study were take aspirin more than two years it form 58%.

Table 4. Comparison of HbA1c level between long and short aspirin duration.

Number	Group	Mean	SD	p. value
12	Less than 2 years	9.071	0.1980	0.048
38	More than 2 years	9.402	0.2194	

This table show the deferent between HbA1c mean is significance for group take aspirin more than 2 years.

Table 5. Comparison of HbA1c level in deferent age group.

Number	Group	Mean	(± SD)	p. value
18	40 – 50	8.8	0.126	0.125
38	51 – 60	9.6	0.178	
35	61 – 70	9.4	0.145	
9	More than 70	8.9	0.0732	

This table reflect the deferent between HbA1c mean according to age group is not significance (p. value 0.125).

Table 6. Comparing of HbA1c level between aspirin taking and not aspirin taking group, and gender.

Group	Number	HbA1c Mean	(± SD)	p. value
Aspirin	Aspirin taking	50	9.6	0.145
	Not aspirin taking	50	9.1	
Gender	Male	50	9.2	0.045
	Female	50	10.6	

This table show the comparing between the mean of HbA1c in patient taking aspirin and patient not take aspirin the p value

is not significance. And show the mean of HbA1c level is more in female than in male and p values is significance at 0.045.

Table 7. Association between HbA1c and aspirin duration, BMI, age and fasting blood glucose.

		Correlation coefficient	Sig (p value)
Aspirin duration	Pearson's correlation	0.490	0.029
BMI		0.674	0.041
Age		0.291	0.087
Fasting blood glucose		0.865	0.002

The results of this study showed the significant association between HbA1c and aspirin duration, BMI and fasting blood glucose. And showed that no significant between HbA1c and age.

4. Discussion

Diabetes is a global endemic with rapidly increasing prevalence in both developing and developed countries. The American Diabetes Association has recommended glycated hemoglobin (HbA1c) as a possible substitute to fasting blood glucose for diagnosis of diabetes. HbA1c is an important indicator of long-term glycemic control with the ability to reflect the cumulative glycemic history of the preceding two to three months. HbA1c not only provides a reliable measure of chronic hyperglycemia but also correlates well with the risk of long-term diabetes complications [10].

This was Cross-Sectional study conducted in Wad Madin town at Abu-Aqula center for diabetic another volunteers in the period from April 2021 to Aug, which aim to compare the effect of aspirin in level of HbA1c among diabetic hypertension using aspirin and other group diabetic hypertensive not using aspirin. The data were collected from 100 patient 50% were male diabetic hypertensive taking aspirin and 50% were female.

The study compare HbA1c level between diabetic hypertensive using aspirin was (9.6 ± 0.19) and mean of diabetic hypertensive not using aspirin (9.1 ± 0.17) the result was not insignificant and p value was (0.141).

The compare of aspirin duration and level of HbA1c the result was significance at 0.048 fore group take aspirin more than 2 years and this agree with [11], whose found chronic use of aspirin more than 4 month can lead to falsely elevated HbA1c and p value is 0.033. However this study disagrees with [12], they found the hemoglobin glycation decrees with aspirin incubation that difference because he done his research in vitro that mean more absorption and well response.

The comparison of HbA1c level between deferent age group was not significance and this disagree with [13] whose found the HbA1c increase 0.085% per 10 years. That difference back to behavior and culture of patient.

The comparison between HbA1c and sex, the HbA1c were more in women than men at p value 0.045 and this agree with [14] whose found HbA1c increase with decrease hemoglobin among Japanese women than men and there are interaction between sex and hemoglobin that effect in HbA1c and disagree with, Qinglin, he was found significant differences ($P < 0.0001$) in HbA1c levels between the male and female groups in the total study population. It specifically

demonstrated that the overall levels of HbA1c were higher in male than that in female [15]. That because the men more moving than women so that moving lead to consume of glucose and less adhere to red blood cell.

The correlation between fasting blood glucose and level of HbA1c it is significance at 0.002 this agree with [16] who found the association of HbA1c with fasting glucose relatively strong correlated and Pearson coefficient was significant at p value (0.002) also HbA1c associated aspirin duration with BMI respectively with p value (0.029) (0.041). And not associated with age p value (0.087).

5. Conclusion

The level of HbA1c increase with aspirin using and associated with fasting blood glucose and BMI. And female have high level of HbA1c than male. The age of patient not effect on HbA1c level.

Consent and Ethical Approval

The research approved and received ethical clearance from the Health Research Committee in the ministry of health at Gezira State and informed consent was obtained from the participant patient.

Competing Interests

Authors have declared that no competing interests exist.

References

- [1] Nadzimah, N., (2009) Uses of hemoglobin A1c in diagnosis of diabetes mellitus international journal of diabetes (30): pp 310-317.
- [2] Chris, F., (2016) Aspirin resistance associated with HbA1c and obesity in diabetic patients journal of BiomarkerInsights volume (18) pp 317 -320.
- [3] Nicola, V and Jacopo, D., (2008) Review of hemoglobin A1c in the management of diabetes. Clinical pharmacology volum 86 issue 8 pp 19-21.
- [4] Unnikrishnan, R., Anjana, R. M., & Mohan, V. (2012). Drugs affecting HbA1c levels. Indian journal of endocrinology and metabolism, 16 (4), 528–531.
- [5] Randier, A., Jack, D., David, E., (2001). measure micro vascular risk complications by HbA1c blood glucose Diabetes care journal, vol. 50, pp 88-93.

- [6] Wheele, E., (2018) Genetics of HbA1c: a case study in clinical translation current opinion in genetic and development pp 79-85.
- [7] Lin, H., & Yi, J., (2017). Current Status of HbA1c Biosensors. *Sensors* (Basel, Switzerland), 17 (8), 1798.
- [8] World Health Organization (2011), Use of Glycated Haemoglobin (HbA1c) in the Diagnosis of Diabetes Mellitus: Abbreviated Report of a WHO Consultation. Geneva, Glycated haemoglobin (HbA1c) for the diagnosis of diabetes.
- [9] Cavagnolli, G., Pimentel, A. L., Freitas, P. A., Gross, J. L., & Camargo, J. L., (2017). Effect of ethnicity on HbA1c levels in individuals without diabetes: Systematic review and meta-analysis. *Journal of PLoS one*, 12 (2), e0171315.
- [10] Sherwani SI, Khan HA, and Ekhzaimy A, *et al.*, (2016). Significance of HbA1c Test in Diagnosis and Prognosis of Diabetic Patients. *Biomark Insights* (11): pp 95-104.
- [11] Camargo JL, Stiff J, Gross JL., (2006). The effect of aspirin and vitamins C and E on HbA1c assays. *Clinica Chimica Acta; International Journal of Clinical Chemistry*. 372 (1-2): pp 206-209.
- [12] Francesco, F., Feliciano, P., and Nolli, P., *et al* (2015) aspirin mediated acetylation of haemoglobin increase in presens of high glucose concentration and decrease protein glycation open jorna *EupA proteomic volume* (8): pp 116-127.
- [13] Dubowitz N., Xue w, and long Q, *et al*, (2014) Ageing is associated with increase Hba1c level independently of glucose level and insulin resistance and also with decrease HbA1c diagnostic specify. *diabetes Med.* (8) pp 927-35.
- [14] TomokoN, junko o, Tadasu k., (2017) effect hemoglobin and sex on hba1c level among Japanese population. *diabetes and endocrinology* ISSN: 2639-8176.
- [15] Qinglin Ma, Houming Liu, and Xiang, G, *et al.*, (2017) assasination between glycated hemoglobin A1c level with age and gender in Chinese adult with no prior diagnosis of diabetes mellitus *journal of biomedical report* pp 73-75.
- [16] Zahra GH, Ali A, Haghdooost MD, and Farzaneh z., (2010) a comparison of HbA1cand fasting blood sugar test in general population *international journal of preventive medicine* 1 (13): p 187-194.