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EVALUATION OF GLYCOSYLATED HEMOGLOBIN (HBA_1C) LEVELS IN NON-DIABETIC SUDANESE SMOKERS

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ABSTRACT

Background: Smoking is associated with an increased risk of insulin resistance and type 2 diabetes mellitus Glycosylated hemoglobin (HbA_1C) is a marker of long-term glucose homeostasis reflecting an average blood glucose concentration in past 2-3 month. Objective: this study was done to evaluated the glycosylated hemoglobin (HbA1C) level in the non diabetics Sudanese smokers and nonsmokers and compare the levels between the two groups to assess the effect of smoking on (HbA1C) level. **Material and Method:** This is cross-sectional case control study. It was performed in Khartoum and white Nile state the study involving 100 participants, all participants were selected randomly from the general population. 50 participants, non diabetic male of age group between (19-67) years who smoke (10) cigarettes per day or more for not less than one year. 50 healthy age matched non diabetic males who do not smoke cigarette were marked as control group. Random blood (HbA1C) concentration was estimated in all subjects and the values were compared between the case and control. **Result:** There was a high significant increase in the (HbA_1C) level in smokers 6.88±0.39 when compared with the non smokers 6.26±0.49 with p.value (0.00). Furthermore there is significant correlation between (HbA_1C) level with duration of smoking and age of smokers in the test group ($r = 0.414$, $p = 0.003$. $r = 0.365$, $p = 0.009$) respectively. **Conclusion:** The study demonstrated that cigarettes smoking in non-diabetic Sudanese individuals caused significant increases in the glycosylated hemoglobin level especially the long-term smoking.

KEYWORDS: Glycosylated hemoglobin (HA_1C), Non-Diabetic, homeostasis. Smokers, Sudanese.

INTRODUCTION

Cigarette smoking is the worldwid public health problem and well – decumented risk factor for cardiovascular disease and many malignancies. Several studies observed that cigarette smoking is associated with an increased diabetic and insulin resistance.[1] Other studies also have report that smokers exhibit higher (HbA1C) level than non smokers.

Nicotine which is the most abundant volatile alkaloid in cigarette, has been illustrated to rises the level of nor epinephrine and epinephrine. Rises of catecholamine level resulted in rises of glycolysis and gluconeogensis in the liver and reduced pancreatic secretion of insulin, that lead to an increases of blood glucose especially in high nicotine levels.[2,3]

Glycosylated hemoglobin (HbA1C) is form of hemoglobin that is formed in non enzymatic glycation pathway by hemoglobin's exposure to blood glucose.[4] HbA1C measure primarily to identity the past three months average blood glucose concentration. The test is limited to three months average science it depends on the life span of RBCs which is 120 days. It serves as sensitive marker of overall glycemic control and risk for long-term diabetic complication.[4,5] In addition it is guide for controlling and adjustment of treatments for diabetic patients as well as monitoring glycemic control and diagnosis of diabetes mellitus. HbA1C values are free from blood fluctuation from day to day and are un affected by physical activities or resent diets.[4,5,6]

Numerous studies have illustrated that current non-diabetic smokers have higher (HbA_1C) concatenation as compared to non smokers.[4-5] Hence this study is conducted to demonstrate the relationship between HbA_1C level and cicrate smoking among non-diabetic Sudanese population.

MATERIALS AND METHODS

This was cross sectional case control study involving 100 participants were selected randomly from the general population in Khartoum state in the period from August to November 2018. 50 are smokers as test group. With age from (19-67) years (37.76±12.16) mean ±SD, in addition to 50 control group healthy non smokers age and gender matched

Exclusion Criteria

Patients with diabetic mellitus, hepatic disease, anemia, hypertension, renal disease, heart disease, hemoglobinpathesis, acute and chronic blood loss, hormonal therapy, steroidal therapy, anticonvulsant therapy, alcoholism, and smokers who smoke less than 10 cigarette per day.

Data collection

Each site used standardized questionair which collected the demographic and symptom information assessed in this study.

Sample collection

Subjects who met the inclusion criteria were then included in the study and their (HbA1C) level was estimated. 3 ml of venous blood was drown from the vein, and collected in EDTA containers.

Biochemical analysis

3 ml of random blood sample were obtained from each subject in EDTA container. Estimation of (HbA1C) level was measured by ichroma^{TM} (HbA_1C) (fluorescence immunoassay FIA).

Quality control

Sample representing the normal and pathological level of the measured analyte was used for assessment of the quality control .Result ±2SD of the target values of the control sera were accepted.

Statistical analysis

Data was analyzed by computer software SPSS program version 22. The mean and standard deviation of HbA_1C level was obtained, and the T- test was used for the comparison of HbA_1C levels between the test and control group, and the mean difference is significant at $p \leq 0.05$, Correlation(r) between HbA_1C level with age, duration and number of smoking is considered to be statistically significant at $P \leq 0.05$

RESULTS

The study population comprised of 100 subjects. 50 are smokers as test group. With age from 19-67 years (m ±SD 37.76±12.16), in addition to 50 control group healthy non smokers age and gender matched. The minimum duration of smoking is one year, while the maximum is

35 year, with mean (13.38 ±8.90) also the minimum number of cigarette is (10) cigarette per day, while the maximum number is 40 cigarette per day with mean (24.70±6.95) depicted in table 1.

Baseline characteristic of study between smokers and control group, which presented the mean of (HbA_1C) concentrations in the study group smokers and control group (6.88±0.39) versus (6.26±0.49) and shows significant increase in the mean of (HbA1C) concatenation in smokers when compared with control groups (p.value 0.000) depicted in table 2.

As shown in figures (1 and 2), there is significant correlation between (HbA_1C) level with duration of smoking and age of smokers in the test group (r = 0.414, p =0.003 . r = 0.365 , p=0.009)respectively .

Table 1: Show the minimum, maximum and the mean and standard deviation of variables in the test group.

Variables	Minimum	Maximum	Mean ± SD
Age(years)	19.00	67.00	37.76±12.16
Duration of smoking(years)	1.00	35.00	13.38±8.90
Number of cigarette per day	10.00	40.00	24.70±6.95

Table 2: Comparison of (HbA1C) level in smokers with non smokers (control).

Group	Mean ±SD	P. Value
Smokers	6.88±0.39	0.000
Non-smokers	6.26±0.49	

The difference is significant at $p \leq 0.05$

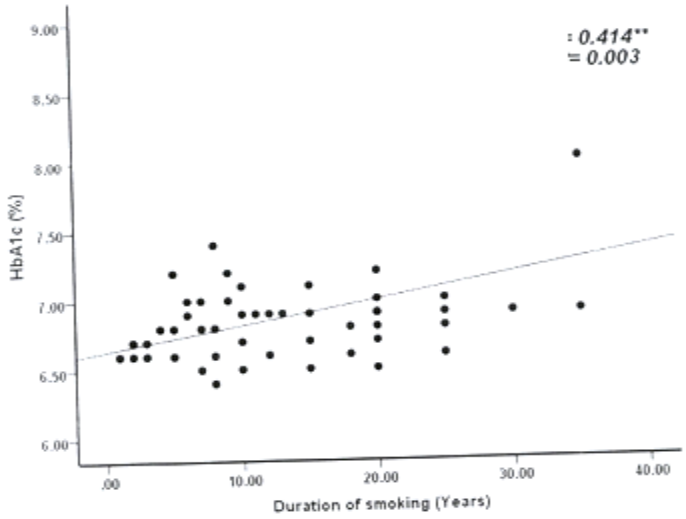

Figure 1: Correlation of glycosylated hemoglobin (HbA_1C) with duration of smoking in the test sample.

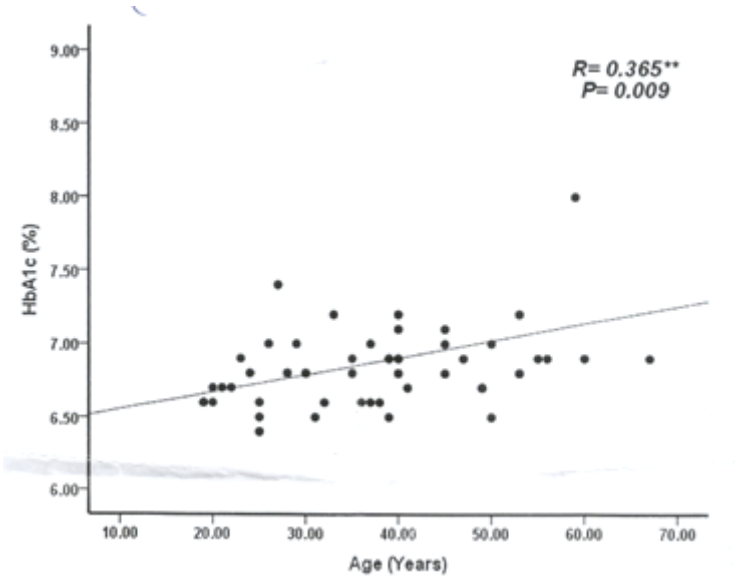

Figure 2: Correlation of (HbA1C) level with age of the test group (smokers).

DISCUSSION

Glycosylated hemoglobin (HbA_1c) is a indicator for past 2-3 months blood glucose homeostasis ,it serves as sensitive index of overall glycemic control and risk for chronic complications in diabetic patients.[6] Furthermore it is guide for controlling and adjustment of treatments for diabetic patients as well as monitoring glycemic control and diagnosis of diabetes mellitus.[6,7,8] However, the levels of HbA1c can be affected by Nemours agents including age,[6,9] ethnicity, disorders that change red cell turnover, socioeconomic , and blood glucose control.[9,10,11]

In the current study the level of HA_1C is significantly increased in non- diabetic smokers when compared with non smoker control groups. Which accord with the studies performed by VIDHYA.,2015,[12] Jae et al.,2015,[13] Martin Urberg et al., 2011[14] and Lincolin et al., 2001.[15] Whom reported that cigarette smokers have significant increase in the glycosylated hemoglobin levels when compared to the non-smokers.

Vlassopoulos et al., 2013,[16] in large population-based study deduced that protein glycation, indicated by HbA1c, is directly correlated with smoking, and negatively associated with vegetable intake. The relation between cigarette smoking and the raised glycosylated hemoglobin may be resulted from the nicotine, Nicotine which is the most abundant volatile alkaloid in cigarette causes increased norepinephrine and epinephrine levels.[17,18] Elevated catecholamines in the blood causes increased glycolysis and gluconeogenesis by the liver. In addition catecholamines decrease the number of binding sites of insulin and slower the

glucose transporters synthesis.[19] Cigarete smoking may reduce insulin sensitivity, or alters the early steps in insulin action involving signal transduction, glucose transport and phosphorylation.[17,18,19]

In the present study the level of HA1C is significantly positively correlated with age in the test group. Which is consistent with Qinglin et al., 2016[20] in China, who concluded that HbA1c levels are associated with age and gender in Chinese populations. With increased age, the pancreatic islets activity decreases, tissue sensitivity to insulin and insulin receptor stimulation reduced, and glucose consumption generally reduces. With the combined action of these agents, blood glucose tend to increases with age , resulted in elevated HbA1c levels especially with advanced age.[21]

In the current study the level of HA1C is significantly ppositivel correlated with duration of smoking in the test group. confirming previous report.[12] Who illustrated that the mean level of glycosylated hemoglobin in smokers is increased with increase in the number of years of smoking.

CONCLUSION

From the result of this study it is concluded that smoking cigarette with high quantity and for a long time lead to increase the level of glycosylated hemoglobin even in non- diabetic.

Consent

As per international standard or university, Standard, patient's written consent has been collected and preserved by the authors.

Ethical Approval

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

Competing Interests

Authors have declared that no competing interests exist.

Authors' contribution

This work was carried out in collaboration between all authors. Author EMH designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the

manuscript. Authors EMH and AMA managed the analyses of the study and the literature searches. All authors read and approved the final manuscript.

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