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The Relationship Between Vegetables and Fruits Intake and Glycosylated Hemoglobin Values, Lipids Profiles and Nitrogen Status in Type II Inactive Diabetic Patients

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Original Article

ABSTRACT

Background: The prevalence of obesity and associated chronic disease such as diabetes is rapidly increasing in all part of the world. The World Health Organization has predicted that between 1997 and 2025 the number of diabetic patients will increase from 143 million to about 300 million. In diabetic patients, oxidative stress leads to non-enzymatic glycosylation of proteins such as hemoglobin and albumin, these proteins can play a significant role in pathogenesis of diabetes and development of chronic disorders in diabetic patients. Antioxidant nutrients can reduce the chronic disorders and complications of diabetes by inhibiting the oxidative reactions. Some important antioxidant such as vitamin A, vitamin C, vitamin E and selenium occur in vegetables and fruits. Our objective of this study was investigation of the relationship between vegetables and fruits intake ssand glycosylated hemoglobin (HbA1C) values in diabetic patients.

Methods: One hundred and five diabetic patients participated in this cross-sectional study. The patients were referred to health center in Khomeini shahr. Glycosylated hemoglobin (HbA1C) values were measured by chromatography method. Data on dietary intake and vegetables and fruits consumption were obtained from validated food frequency questionnaires.

Results: The unadjusted mean glycosylated hemoglobin (HbA1C) is significantly associated with the amount of vegetables and fruits intake ($P = 0.014$), but the relationship between consumption of fruits and HbA1C is not significant and the relationship between consumption of vegetables and HbA1C was roughly significant ($P = 0.049$). There were no significant relationship between vegetables and fruits intake and lipids profiles, BUN/creatinine and 24 h urinary protein ($P > 0.05$).

Conclusions: Intake of vegetables and fruits may reduce the glycosylated hemoglobin, therefore choosing the appropriate diet with high fruits and vegetables may help to develop antioxidant defense and reduce the HbA1C in diabetic patients but it did not have any impact on lipids profiles, BUN/creatinine and urine protein 24 h.

Keywords: BUN/creatinine, glycosylated hemoglobin (HbA1C), lipids profiles, vegetables and fruits intake, 24 h urinary protein

INTRODUCTION

Today, diabetes is considered as one of the most common metabolic disease worldwide and an important factor for death and disability in various countries including Iran.[1] World Health Organization predicted from 1997 to 2025 increasing of number of people with type II diabetes worldwide 143 million to 300 million.[2] Although obesity and physical inactivity are most important risk factors for type 2 diabetes, but recent evidence suggests that oxidative stress play an important role in pathogenesis of this disease.[3] Increased insulin resistance and higher glucose and free fatty acids levels can increase the amount of active oxygen and generate oxidative stress in the body and activate pathways that are sensitive to stress[4-6] and following by it, free radicals impair insulin action through changes in the physical condition of target cell membrane.[7-9] On the other hand, non-enzymatic glycosylation reactions of proteins such as hemoglobin have been identified as major factors in the pathogenesis of chronic disorders of diabetes. Antioxidants not only improve insulin secretion and performance through neutralizing free radicals, but also improve regulation of blood sugar and reduce complications of type II diabetes and chronic disorders.[10] Also, inhibiting non-enzymatic glycosylation reactions of proteins can be effective on reducing chronic complications of diabetes disorders.[11] Fruits and vegetables are considered as rich resources in certain antioxidants, including carotenoids, vitamins A, C, E and some minerals such as selenium. According to a study by Ceriello, taking the vitamins such as A, C and E reduce glycosylated hemoglobin and can thus be effective in reducing diabetes complications.[12,13] According to another study by Lupo, in parts of the world which Mediterranean diet, including fruits and vegetables and oilseeds is high, the prevalence of type II diabetes are less.[14] In another study by Laura Franzin in 2008, there was an inverse relationship between levels of plasma antioxidants and HbA1C, in other words the levels of antioxidants were higher in patients who had glycosylated hemoglobin <7 (HbA1C <7).[15] Because of high incidence of diabetes rising in Iran and its effects on patients with compensated interminable and that seems one of the possible causes can make be through the antioxidant system deficiency; hence the evaluation of relationship between antioxidant intake and levels of glycosylation reactions seems necessary. In addition, the effect of vegetables and fruits intake on lipids profiles, BUN/creatinine and urine protein 24 h also is our study objective consideration.

METHODS

This cross-sectional study was performed in 2010 on 105 patients with type II diabetes referred to the health center of Khomeinishahr located in Isfahan County in Iran. Cases selected throughout simple sampling and were justified for participate to this study. Initially, the profile patients including age, sex, education, occupation, smoking status, diabetes family history, age of diabetes onset, history of other diseases, drug consumption, height, weight, BMI and activity levels were recorded via questionnaire. Before entering the study, subjects were given written informed consent and were described the aim and process of study and the individuals were asked if they wish to participate in the study. Including criteria were diabetes, referring to Khomeini Shahr health centers in 2010 and were not pregnant. HbA1C measurement performed via blood test, analyzer DS5 and pink Reagent kit. Dietary data was obtained via a validated food frequency questionnaire (FFQ). To help people recall the exact amount of food eaten, we applied household utensils and cups and then for listed foods we used home scales manual and converted all of them to gram unit. For nutrient analysis, the amount of grams of food consumed was compiled by Nutritionist 4 program. And for doing statistical analysis, SPSS software was compiled. To determine the correlation relationship between hemoglobin and independent variables Pearson and Spearman correlation coefficient was needed. To determine the severity of relationship between consumption of vegetables and fruits and glycosylated hemoglobin levels, linear regression was used.

RESULTS

In this study, the mean consumption of fruits was 1.3 units and for consumed vegetables was 1.9 units, while the food pyramid recommended to get 2-4 units of fruits and 3-5 units of vegetables, and this indicated that the subjects do not receive at least average of fruits and vegetables recommended in food guide pyramid. In general, the distribution of total consumption of vegetables and fruits had a normal distribution. Also the correlation between consumption of fruits and vegetables at the 0.05 significance level was observed [Table 1].

Mean glycosylated hemoglobin (HbA1C) was estimated 9.3 percent when people did not get fruits and vegetables. If fruit consumption is assumed constant, increasing consumption of 10 grams vegetables caused reducing 0.03 percent of glycosylated hemoglobin (HbA1C) that this effect is borderline significant (P = 0.049), and if vegetables consumption assumed constant, increasing consumption of 10 grams fruits, caused reducing 0.02 percent of glycosylated hemoglobin but this effect was not significant. When in regression model, biased variables such as sex, age, drug consumption, diabetes type be added to the model, the effects of fruits and vegetables on glycosylated hemoglobin (HbA1C) did not differ, but coefficients obtained in regression was not statistically significant. When the effect of both of fruits and vegetables consumption on glycosylated hemoglobin (HbA1C) was considered, it can be said that by increasing consumption of 10 grams of fruit and vegetables, glycosylated hemoglobin (HbA1C) significantly reduced 0.02 percent (P = 0.014) [Table 2]. The relationship between HbA1C levels and consumption of both of fruits and vegetables at the same time are shown in Figure 1.

Table 3 and Table 4 show that there were no significant relationship between consumption of fruits and vegetables and lipids profiles, BUN/creatinine and urine protein 24 h ($P > 0.05$).

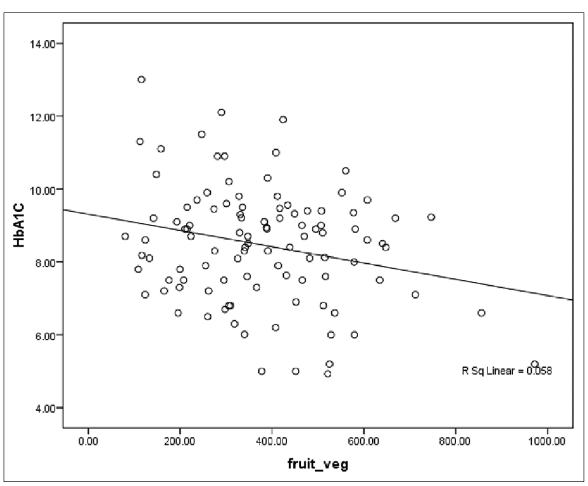

Figure 1: Scatter plot to a and vegetables HbA1C

DISCUSSION

The aim of this study was to determine

Table 1: Linear correlation between consumption of fruits and vegetables

Variables	Intake of total fruits and vegetables	Consumption of vegetables	Consumption of fruits
HbA1C Pearson correlation coefficient	−0.240*	−0.218*	−0.158
P value	0.014	0.025	0.107
Counts	105	105	105

*Significant relationship at 0.05 level

Table 2: Regression table, the relationship between consumption of fruits, vegetables and consumption of total vegetables and fruits with HbA1C

Rate	B	*P* value	95.0% C.I	
			Upper	Lower
Fruits consumption rate	−0.002	0.107	0.000	−0.005
Vegetables consumption rate	−0.003	0.025	0.000	−0.006

Table 3: Relationship between vegetables and fruits intake and BUN/creatinine and urine protein 24 h

Variables	Vegetables and fruits	BUN	Creatinine	24 H prot
Vegetables and fruits				
Pearson Correlation	1	0.033	0.025	0.066
Sig. (2-tailed)		0.797	0.847	0.710
N	100	63	62	34
BUN				
Pearson Correlation	0.033	1	0.091	0.063
Sig. (2-tailed)	0.797		0.382	0.745
N	63	111	95	29
Creatinine				
Pearson Correlation	0.025	0.091	1	0.038
Sig. (2-tailed)	0.847	0.382		0.851
N	62	95	117	27
24H prot				
Pearson Correlation	0.066	0.063	0.038	1
Sig. (2-tailed)	0.710	0.745	0.851	
N	34	29	27	41

Table 4: Relationship between vegetables and fruits intake and lipids profiles

Variables	Vegetables and fruits	CHOL	HDL	LDL
Vegetables and fruits				
Pearson Correlation	1	−0.026	0.089	−0.094
Sig. (2-tailed)		0.815	0.407	0.385
N	100	86	88	88
CHOL				
Pearson Correlation	−0.026	1	0.066	0.631
Sig. (2-tailed)	0.815		0.427	0.000
N	86	173	148	146
HDL				
Pearson Correlation	0.089	0.066	1	0.037
Sig. (2-tailed)	0.407	0.427		0.646
N	88	148	156	154
LDL				
Pearson Correlation	−0.094	0.631	0.037	1
Sig. (2-tailed)	0.385	0.000	0.646	
N	88	146	154	154

consumption of fruits and vegetables influence on the levels of glycosylated hemoglobin (HbA1C) in type II diabetic patients. Various studies have shown that oxidative stress can play pathological role in many chronic diseases including obesity and diabetes. For example, according to a case-control study by Ceriello, it was shown that serum antioxidant capacity reduced in diabetes patients.[16] In another case-control study by Goodarzi in Iran show that plasma levels of malondialdehyde (final product of fatty acids peroxidation due to increased free radicals) in diabetic patients is higher than normal and significantly relationship between oxidative stress and blood glucose levels was demonstrated in this study.[17] Many clinical trial or laboratory studies show that supplementation with some antioxidants like vitamin E, vitamin C or alpha-lipoic acid (ALA) could improve oxidative stress markers or levels of glycosylated hemoglobin (HbA1C) in diabetic patients. For example, according to a study conducted by Ceriello, glycosylated hemoglobin levels significantly reduced in group received vitamin E.[12] In a cross-sectional study by Sargeant on 2,678 men and 3,318 women, fruits, vegetables and other leafy vegetables consumption rate was evaluated with levels of glycosylated hemoglobin (HbA1C) and showed that there is a significant relationship between receiving too much fruits or vegetables and glycosylated hemoglobin (HbA1C).[18] Although, hyperglycemia is involved as a primary factor in diabetes complications but it is still unclear whether path physiologic processes is identical in all diabetic complications or different mechanisms are involved in different organ diabetes complications. In general it can be said that oxidative stress and free radical production are involved as a hyperglycemia consequence of diabetes complications.[19] Antioxidants are found in foods as a powerful supplement to reduce oxidative stress. There is evidence that rich of antioxidant diets reduced oxidative stress in patients with type II diabetes.[20] Often it is observed in type II diabetic or pre-diabetic patients, exogenous antioxidants compensate decreased plasma levels of plasma antioxidants. A recent hypothesis considered is that the consumption of vegetables and fruits that are rich of vitamins and other antioxidants can cause persistent high levels of antioxidants in diabetic patients.[21,22] According to the results obtained in this study, it showed that consumption of fruits and vegetables can reduce HbA1C levels and thus can be effective to reduce complications related to diabetes. There was a linear relationship between HbA1c and dyslipidemia. The findings of previous study clearly indicate that HbA1C is a useful biomarker of long-term glycemic control and can also predict lipid profile, thus, monitoring of glycemic control using HbA1C could identify diabetic patients who are at a greater risk of cardiovascular complications.[23-25] In spite of relationship between HbA1C and lipid profile, the impact of consumption of fruits and vegetables on HbA1C level was not the same on lipid profile, in this study. In general there was no significant relationship between consumption of fruits and vegetables and lipids profiles, BUN/creatinine and urine protein 24 h.

CONCLUSION

In this study, subjects did not receive least average of fruits and vegetables recommended in food pyramid and so should be advised to get more fruits and vegetables, also recommended to consider the impact of lifestyle factors in such studies.

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