

## Is responsiveness to weight loss diets affected by family history of diabetes?

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### Original Article

#### Abstract

**BACKGROUND:** Obesity is associated with many metabolic and chronic diseases, such as diabetes and cardiovascular disease. Family history of diabetes (FHD) is also an important risk factor for type 2 diabetes. Furthermore, the presence of FHD and obesity has a synergic effect on risk of diabetes incidence. The aim of this study was to determine whether FHD influence the weight loss induced by weight loss diet.

**METHODS:** This study was an intervention between individuals with or without FHD. Seventy-eight positive FHD and 74 negative FHD individuals were participated in this study. Two groups were matched for age, gender, and body mass index (BMI). In the present study, expert interviewers collected socio-demographic data and prescribed dietary recommendations in a face-to-face method.

**RESULTS:** Dietary intervention significantly reduces the body weight and BMI in both groups, but these reductions were not different between negative and positive FHD groups. This study could not find any significant association between FHD and responsiveness to weight loss diets ( $\beta = -0.058$ ; 95% confidence interval,  $-1.618$  to  $0.832$ ;  $P = 0.526$ ).

**CONCLUSION:** Individuals with FHD have higher risk for obesity and chronic diseases, but in the current study there was no difference in responsiveness to weight loss in individuals with a positive family history and those without a family history.

**Keywords:** Body Weight, Body Mass Index, Weight Loss Diet, Family History of Diabetes

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#### Introduction

Obesity has considered as one of the serious health problem.<sup>1</sup> During the previous decades, incidence of obesity has increased even faster,<sup>2,3</sup> so that in 21<sup>st</sup> century, obesity is become one of the most important health problem.<sup>4</sup> Obesity in Iran has also increased during a 14-year period, in order that the prevalence of obesity increased 5.8% and 17.4% in men and women, respectively, which become 10.5% in men and 17.4% in women.<sup>5</sup> Obesity is associated with many metabolic and chronic diseases, such as diabetes, cardiovascular disease, arthritis, respiratory diseases and some cancers.<sup>6</sup> In the pathogenesis of glucose intolerance and metabolic diseases, the effects of obesity have been documented.<sup>7</sup> In another investigation, insulin sensitivity is negatively associated with body mass index (BMI).<sup>7</sup> It has been shown that obesity is the main potentially risk factor for type 2 diabetes.<sup>8</sup> Moreover, in some

experimental and cohort studies, weight gain is positively related with risk of diabetes mellitus.<sup>9-11</sup>

Diabetes as a major risk for mortality and morbidity has great direct and indirect costs.<sup>12</sup> Family history of diabetes (FHD) is an important risk factor for type 2 diabetes. In some prospective studies, higher risk for type 2 diabetes was positively associated with FHD.<sup>13,14</sup> Based on case definition and study design, FHD has 2-6 times higher risk for type 2 diabetes.<sup>15</sup> Moreover, in a cross-sectional study, individuals with positive FHD had higher adiposity than individuals without a family history.<sup>16</sup> Furthermore, the presence of FHD and obesity has a synergic effect at risk of diabetes incidence.<sup>17</sup> There are evidences that show lifestyle interventions such as dietary changes, physical activity, and weight loss in overweight people is associated with enhanced insulin-glucose homeostasis and could decrease the type 2 diabetes risk.<sup>18,19</sup> Moreover, in

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subjects with type 2 diabetes, weight loss has positive effects on glycemic control, insulin sensitivity, and diabetes complications.<sup>20</sup>

During previous decades, Iran like other developing countries has faced with swift changes in many phases such as urbanization, lifestyle and dietary habits, and as a result, obesity and diabetes has become more critical health problem. FHD could be an important target group for lifestyle modification, which we expect to improve health outcome and postpone disease arrival. A randomized clinical trial on impair glucose tolerance patients confirmed that weight loss, fat intake reduction and physical activity could decrease the type 2 diabetes by 58%.<sup>18</sup> Genetic or behavioral factors have effects on glycemic control in FHD. For instance, people who have parental history of diabetes may have higher insulin resistance and poorer glycemic control because of their genetic factors, which could lead to obesity and influence the pathogenesis of their disease. To the best of our knowledge, there is no study that considers whether FHD has any effect on weight loss mediation. Doing this study may improve our understanding of the known genetic differences for weight loss intervention. We conducted a study to determine this effect and find out if FHD influence the weight loss diet.

## Materials and Methods

### Study population

We conducted an intervention study involving overweight or obese Iranian adults (BMI > 25) without diabetes who were participating in the weight loss program in Salamat Clinic in 2009. Based on convenience non-random sampling procedure, 78 people with positive FHD and 74 negative FHD participants were participated in this study. Participants with at least one first-degree relative with diabetes were considered positive family history. First-degree relatives could be father, mother, sibling or child. Controls were obese people without FHD. People who had missing socio-demographic, family history or dietary variable data were excluded from the study. Two groups were matched for age, gender and BMI. From each participant a written informed consent was obtained.

### Assessment of variables

Socio-demographic data such as age, gender, education, and FHD were self-reported. Assessment of weight and height was completed while participants were barefoot and wearing light clothes. Subjects' weights were measured using a digital scale to the nearest 0.1 kg and heights were measured by a wall

fixed measuring tape to the nearest 0.1 cm. As a measure of obesity, BMI was calculated as weight (kg) divided by height square (m<sup>2</sup>). Measurement of waist circumference (WC) was done horizontally between lowest rib margin and the iliac crest by a measuring tape and for the hip circumference at the widest point. Waist to hip ratio was calculated as WC divided by hip circumference. Dietary intake was assessed with a single 24 h dietary recall to evaluate subjects' food habits. Participants' data were assessed at baseline and 6 months after the dietary interventions.

### Dietary intervention

All patients were treated based on the usual dietary programs. For each subject, energy requirement was calculated by Harris and Benedict equation.<sup>21</sup> For weight loss diet, energy intake was reduced by 500 kcal in all people. All diets and foods were self-selected based on habits and preferences. We asked the participant to reduce fat intake by 30% of their total energy intake. For every subject weekly individual meetings were arranged to assure compliance to the arranged diet, and discuss success strategies and correct the diet if necessary.

### Statistical methods

For all statistical analyses in this study, we used SPSS for windows (version 15, SPSS Inc., Chicago, IL, USA). Test of normality with Kolmogorov-Smirnov test showed that the data were normally distributed. To compare means of continues variables between positive and negative FHD groups, we applied Student's t-test and for categorical variables chi-square test was used. Linear regression was used to discover the associations between positive FHD and weight and BMI.

## Results

The characteristics of total study population and separated by FHD are provided in table 1. There was no significant difference between individuals with negative FHD and those with a positive history in age, sex, weight, BMI, and WC at the baseline point. Based on the results of table 2 which shows the effect of weight loss diet on body weight in people with positive FHD and participants with negative FHD, dietary intervention significantly reduces the body weight and BMI in both groups, but these reductions were not different between negative and positive FHD groups (P = 0.526 and P = 0.413 for weight and BMI, respectively). Table 3 shows the simple linear regression between FHD and the effect of dietary weight loss. In this study, we failed to find any significant association between FHD and responsiveness to weight loss diets.

**Table 1.** Characteristics of study participants based on family history of diabetes\*

Baseline characteristic	Total	Negative FHD	Positive FHD	P
Age (year)	36.62 ± 14.13	37.90 ± 15.44	34.64 ± 11.70	0.189
Weight (kg)	80.42 ± 16.65	78.93 ± 16.45	82.71 ± 16.88	0.223
BMI (kg/m <sup>2</sup> )	30.34 ± 5.56	29.61 ± 5.46	31.40 ± 5.59	0.089
Waist circumference (cm)	88.97 ± 12.69	87.38 ± 14.00	90.75 ± 10.92	0.217
Waist to hip ratio	0.82 ± 0.07	0.82 ± 0.07	0.83 ± 0.07	0.918
Sex (female) (%)	77.9	70.3	89.6	0.120

\* Data are means ± standard error unless indicated; FHD: Family history of diabetes; BMI: Body mass index

**Table 2.** Comparing the effect of dietary intervention on body weight and body mass index in individuals with and without family history of diabetes

	Positive FHD				Negative FHD				P**
	Beginning	End	Differences	P*	Beginning	End	Differences	P*	
Weight (kg)	82.71 ± 16.88	81.28 ± 16.43	1.43 ± 4.59	0.036	78.93 ± 16.45	77.11 ± 15.29	1.82 ± 2.18	P < 0.001	0.526
BMI (kg/m <sup>2</sup> )	31.40 ± 5.59	30.86 ± 5.36	0.53 ± 1.71	0.038	29.61 ± 5.46	28.89 ± 5.09	0.73 ± 0.76	P < 0.001	0.413

\* P compares the effect of diet in each group; \*\* P compares the differences between positive FHD group and negative FHD group; FHD: Family history of diabetes; BMI: Body mass index

**Table 3.** Simple linear regression between family history of diabetes and dietary weight loss effect

	β	95% CI	R <sup>2</sup>	P
Weight	-0.058	-1.618 to 0.832	0.003	0.526
BMI	-0.077	-0.656 to 0.271	0.006	0.413

CI: Confidence interval; BMI: Body mass index

## Discussion

In this study, the influence of FHD on weight loss in responses to diet induced weight loss was examined. We found a significant decrease in body weight after dietary intervention in both groups; however, we failed to find any significant difference in weight loss between individuals with positive FHD and those with negative FHD.

It has been well-known that FHD is correlated with higher risk of developing diseases.<sup>15</sup> It has also been found that parental history of diabetes is associated with insulin resistance, and high fasting insulin levels.<sup>22</sup> Body weight, BMI, glucose, triglyceride, and low-density lipoprotein cholesterol are positively related with higher insulin levels;<sup>23</sup> however, in the present study, there was no difference in body weight and BMI in individuals with or without FHD. Obesity and FHD simultaneously could greatly increase the risk of chronic diseases,<sup>17</sup> conversely, lowering body weight could decline the risk of diabetes, so weight loss is an excellent treatment for obese patients with FHD. Although FHD could be a significant risk factor for obesity<sup>24</sup> in our study, it had no effect on weight loss as compared with normal individuals, which is particularly in line with previous studies that during weight loss intervention type 2 diabetic patients lose weight as much as diabetic individuals.<sup>25</sup> FHD may affect glycemic control through behavioral or

genetic mechanism. They may have poorer glycemic control because of their genetic risk factors, and on the other hand, they may have enhanced health behavior or knowledge of disease risk factors or they may have received more encouragement to lose weight that could lead to better glycemic control.<sup>26</sup> Individuals with a positive FHD engaged in health protective activities such as weight control behaviors more than individuals without FHD.<sup>27</sup> Since, many of them consider themselves to be at higher risk, they may engage in these behaviors.

Several limitations deserved comment in this study. First of all, in this study, we used convenient sampling and we could not generalize it to our population. Second, self-report was the most important method to obtain the information, which may cause bias in measurement. Third, it is estimated that between 33% and 50% of people with diabetes has not been recognized<sup>28</sup> so people may not know about the diabetes status of all of their family members which may lead to misclassification. Finally, we were unable to discriminate between type 1 diabetes and type 2 diabetes and so we were unable evaluating its effect on their family members.

## Conclusion

Although individuals with FHD have higher risk for obesity and chronic diseases, in the current study, there was no difference in responsiveness to weight loss in individuals with a positive family history and those without a family history. Further investigations with higher sample size and longer period of intervention are necessary to confirm this relationship.

## Conflict of Interests

Authors have no conflict of interests.

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