ORIGINAL ARTICLE

Attribution of lifestyle risk factors in subjects with and without Impaired Fasting Glucose

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Abstract

Objective: To investigate the association between lifestyle risk factors and impaired fasting glucose level.

Methods: The large-scale, community-based, cross-sectional study was conducted in 2012 in Ilam province, Iran, and comprised 150 impaired fasting glucose cases and 450 controls. Face-to-face interviews were conducted using a standard lifestyle questionnaire, and subjects were checked for fasting plasma glucose. Chi-square test and multivariate logistic regression were used for statistical analysis.

Results: Of the 600 participants, 172(28.7%) were males and 428(71.3%) were females. Their ages ranged from 20 to 83 years with a mean of 48.9±14.2 years for the cases and 45.5±13.4 years for the controls ($p<0.008$). There was no statistically significant difference in terms of age, gender, marital status, location, family history of diabetes and body mass index in the two groups ($p>0.05$). Using multivariate logistic regression, ghee consumption increased the risk of impaired fasting glucose up to 2.2 folds (Odds Ratio=1.28, 95% Confidence Interval: 0.75-2.2); inactivity up to 2.33 folds (Odds Ratio=1.33, 95% Confidence Interval: 0.75-2.33) and smoking up to 3.13 folds (Odds Ratio=1.46, 95% Confidence Interval: 0.68-3.13). The differences were not statistically significant.

Conclusion: Risk of impaired fasting glucose increases with lifestyle risk factors that need to be considered seriously by policy makers.

Keywords: Lifestyle, Risk factors, Impaired fasting glucose, IFG, Iran. (JPMA 64: 936; 2014)

Introduction

The American Diabetes Association (ADA) and World Health Organisation (WHO) have different definitions of impaired fasting glucose (IFG). ADA defines IFG by using values of fasting glucose between 100 and 125mg/dl, while the corresponding value for WHO is between 110 and 125mg/dl.[1,2] IFG is a common glycaemic disorder in the general population and is considered as a pre-diabetic state. This condition is believed to be more applicable and more reproducible to describe pre-diabetes rather than impaired glucose tolerance (IGT) that is defined as having two hours postprandial glucose of 140-199mg/dl.[3]

Pre-diabetes is a state in which patients have blood glucose levels higher than normal, but not as high as to be classified as diabetes that show an intermediate stage of a change in glucose metabolism between normal glucose levels and diabetes. In addition, they have an increased risk of developing diabetes by 3-10 folds plus heart diseases and stroke.[4,5]

Different studies have shown that the onset of diabetes can be postponed or even prevented in IFG patients by following appropriate preventive measures and adopting healthy lifestyles.[6,7] Unhealthy eating habits, tobacco smoking and physical inactivity are key aspects of lifestyle that increase the risk of major diseases such as diabetes.[8,9] In fact, for public health section, focussing on detecting people with pre-diabetes and managing them through an effective lifestyle intervention is an important and complicated challenge.[10]

The National Survey of Risk Factors for Non-Communicable Diseases of Iran stated that 16.8%, comprising 4.4 million of Iranian people aged 25-64 years had IFG.[11] One study in Iran showed that body mass index (BMI) and waist circumference (WC) were predictive factors for progression of pre-diabetes to diabetes.[12] Phuong et al. found that risk factors of pre-diabetic subjects were high body fat percentage and daily excessive sugar consumption, but hypertension, smoking, low vegetable intake and physical inactivity

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were not statistically significant risk factors.[13]

In general, few recommendations have been prepared for the diagnosis of risk factors in subjects with pre-diabetes, including IFG, in Iranian people. The present study aimed at providing some detailed information on the lifestyle risk factors associated with the prevalence of IFG in a population located in western Iran.

Subjects and Methods

The large-scale, community-based, cross-sectional study of non-communicable diseases was conducted in 2012 in Ilam province, western Iran, which has a total population of 565000.[14] IFG cases were subjects with fasting plasma glucose (FPG) between 100 and 125mg/dl after fasting for more than 8 hours.[1] Three healthy controls with FPG<100mg/dl were selected for each case using the simple randomised sampling from the main SPSS database.

All participants were permanent local residents and aged ≥20 years old. A total of 2158 subjects, using cluster sampling, completed the initial interview. We examined subjects of Ilam County from the total sample of the province. These subjects were related to 4 urban and rural health centres (2 health centres for each area), as well as centres were selected using cluster sampling. Those excluded were subjects who had FPG>125mg/dl. Those with history of hyperglycaemia and those using anti-hypertension drugs were also excluded.

As a pilot study, data of 20 cases and 60 controls were used to estimate the actual sample size for a statistical power of 80% and an alpha error level of 5%. Since all subjects were consumers of fruits and vegetables and the frequency of smoking in the two groups was equal (5%), the minimum sample size for these variables was not performed. Considering the frequency of positive physical activity for cases (70%) and controls (94.9%), as well as, the ghee consumption for cases (30%) and controls (13.3%), the minimum sample size for these two variables was 35 and 95 subjects in each group, respectively. We, however, had 150 cases and 464 controls available in the database. Of them, 14 excess controls were excluded using randomised sampling to have one case versus three controls.

The study protocol was approved by the Ilam University of Medical Sciences Ethics Committee. Each subject gave informed oral consent before the study. All participants were interviewed by health professionals using standard questionnaires to obtain information on demographic data, including age, gender, marital status, and residential area, as well as hypertension medication history, history of hyperglycaemia and family history of diabetes in first-degree relatives i.e. parents, siblings and children, plus lifestyle related factors including weekly fruit and vegetable intake, weekly ghee intake, daily physical activity at least 30 minutes and daily smoking regardless of its frequency, using 'no' or 'yes' scale. One reason for considering ghee in our study was that Iranian foods in western provinces are usually higher in calories and fat, particularly pure ghee i.e. high in saturated fat plus butter and other similar products containing fatty acids.[15] Height and weight were measured to calculate BMI as an indicator of overall adiposity.

Data analysis was performed using SPSS 16. Chi-square test, independent sample T-test and multiple logistic regression analysis were performed and the latter was used to control the effects of confounding variables. In addition, odds ratio (OR) with 95% confidence interval (CI) was estimated for comparing IFG and normal individuals. P values were two-sided and considered significant when <0.05.

Results

Of the 2158 subjects who competed the initial interview on province-wide scale, 802(37.16%) belonged to Ilam County which formed the study sample from which 122(15.2%) were excluded as they had FPG>125mg/dl; 36(4.5%) because they had a history of hyperglycaemia; and 40 (5%) for currently using anti-hypertension drugs. The final study sample stood at 600 (75%); 150(25%) cases and 450(75%) controls.

Of the 600 subjects, 172(28.7%) were males and 428(71.3%) were females. Their ages ranged from 20 to 83 years, with a mean of 48.9±14.2 years for the cases and 45.5±13.4 years for the controls (p<0.008). There was no statistically significant difference in terms of age, gender, marital status, location, family history of diabetes and BMI in the two groups (p>0.05). The frequency of cases who reported family history of diabetes was higher than the controls (n=8; 5.6 vs. N=13;3.1%). The mean BMI in the two groups was just about the same (Table-1).

Considering lifestyle risk factors, all subjects reported weekly consumption of fruits and vegetables. The frequency of weekly ghee intake in the cases was more than the controls (n=27; 18% vs. n=61; 13.6%) (Table-

Table-1: Socio-demographic characteristics.

Variables	IFG* (N=150) No. (%)	Controls** (N=450) No. (%)	Unadjusted OR, (95% CI)	P value
Age (years)				
20-29	15 (10.0)	58 (12.9)		
30-39	28 (18.7)	96 (21.4)		0.38
40-49	36 (24.0)	124 (27.6)		
50-59	34 (22.7)	88 (19.6)		
60 and higher	34 (22.7)	83 (18.5)		
Gender				
Female	100 (66.7)	328 (72.9)	1.34	
Male	50 (33.3)	122 (27.1)	(0.9-2)	0.14
Marital Status				
Single	10 (6.7)	36 (8.0)	1.21	
Married	140 (93.3)	414 (92.0)	(0.58-2.51)	0.72
Residential area				
Rural	35 (23.3)	136 (30.2)	1.42	
Urban	115 (76.7)	314 (69.8)	(0.92-2.18)	0.11
Family history of diabetes				
No	134 (94.4)	410 (96.9)	1.88	
Yes	8 (5.6)	13 (3.1)	(0.76-4.64)	0.19
BMI (mean ± SD)	24.6 ± 3.3	24.8 ± 3.1		0.42

*Impaired fasting glucose: FPG between 100 and 125 mg/dl. **Controls or Normal glucose: FPG < 100 mg/dl. IFG: Impaired fasting glucose. OR: Odds Ratio. BMI: Body Mass Index. SD: Standard Deviation.

Table-2: Association of lifestyle risk factors with occurrence of IFG.

Variables	IFG (N=150) No. (%)	Controls (N=450) No. (%)	Unadjusted OR, (95% CI)	P value
Fruits and Vegetables intake				
No	0 (0.0)	0 (0.0)		
Yes	150 (100)	450 (100)	-	-
Ghee intake				
No	123 (82.0)	389 (86.4)	1.4	
Yes	27 (18.0)	61 (13.6)	(0.85-2.3)	0.18
Physical activity				
No	23 (15.4)	50 (11.2)	0.69	
Yes	126 (84.6)	397 (88.8)	(0.4-1.17)	0.19
Smoking				
No	137 (91.3)	424 (94.2)	1.54	
Yes	13 (8.7)	26 (5.8)	(0.77-3.09)	0.25

IFG: Impaired fasting glucose. OR: Odds Ratio.

2), and though not statistically significant, ghee intake increased the risk of IFG up to 2.2 folds (OR=1.28, 95% CI: 0.75-2.2) (Table-3).

The cases had a lower regular physical activity compared to the controls, and inactivity increased the risk up to 2.33 folds (OR=1.33, 95% CI: 0.75-2.33). In addition, the proportion of smokers was higher among the cases and though not statistically significant, smoking increased the risk of IFG up to 3.13 folds (OR=1.46, 95% CI: 0.68-3.13).

Table-3: Results of logistic regressions for desired variables.

Variables	Adjusted OR	95% CI	P value
Age	1.015	1-1.03	0.05
BMI	0.96	0.9-1.03	0.32
Gender	1.2	0.78-0.1.85	0.39
Marital status	1.7	0.75-3.87	0.2
Residential area	1.47	0.9-2.41	0.12
Family history of diabetes	2.23	0.86-5.72	0.09
Ghee intake	1.28	0.75-2.2	0.35
Physical activity	1.33	0.75-2.33	0.32
Smoking	1.46	0.68-3.13	0.32

OR: Odds Ratio. CI: Confidence Interval. BMI: Body Mass Index.

Discussion

In this community-based, cross-sectional study of IFG in an Iranian population, we confirmed previous reports of significant and insignificant associations between FPG and lifestyle risk factors, including saturated fatty acid (ghee) intake, physical activity and smoking.[13,16,17]

The present study showed that all subjects consumed fruits and vegetables weekly. Regular intake of fruits and vegetables can decrease the plasma glucose level.[18,19] The reason may be that the population in our study lived in the agriculture-based area, and so fruits and vegetables were often one of their daily foods. Studies conducted in Vietnam and Nauru found that the daily fruit and vegetable intake had almost a similar distribution in their two groups.[13,20] However, the two studies assessed daily intake, while the current study took a weekly picture that will increase the chance of intake.

The frequency of those who consumed larger quantities of ghee was higher among IFG, and ghee intake increased the risk of IFG up to 2.2 folds. This finding shows that ghee intake should be more conservative in Iranian population, because the insignificant impact found in the study may be referred to the ADA definition. Similar to our study, Phuong et al declared that subjects with higher fatty food regimen had about 2.8 times higher risk of pre-diabetes compared to the control group. The difference was significant, but that study considered all fatty foods while we considered only one specific oil.[13] In another study, increased intake of saturated fat was associated with higher frequency of IFG.[17] Diabetes decreases the high density lipoprotein (HDL) and simultaneously increases low density lipoprotein (LDL). Therefore, the IFG subjects should decrease the intake of high-fat dairy items.[21]

Physical activity is one of the best ways to prevent pre-diabetes. People who have a sedentary lifestyle often have insulin resistance. Activity can help improve insulin resistance and help cells to use glucose.[22] A systematic review on association of physical activity and diabetes showed that physical activity such as moderate walking can substantially reduce the risk of type 2 diabetes.[23] In this study, those who did not have a regular physical activity showed up to 2.33 folds the risk of IFG. Our finding was almost similar to other reports.[13,20] In addition, one cohort study revealed that high physical activity in IFG subjects can decrease the incidence of diabetes.[24]

Although the association between smoking and diabetes was known from different studies, such an association is not fully determined yet.[25] According to our study, smoking in the cases was more frequent compared to the controls and increased the risk of IFG up to 3.13 folds. Studies conducted in Iran with criterion similar to our study for IFG, found that even though the frequency of smoking in IFG groups was higher compared to normal FPG groups, their differences weren't significant even though in one of them their criteria for smoking included past and current smokers, while in our study daily current smoking was considered.[26] Khambalia et al's study with similar criteria for smoking showed that smokers had up to 1.94 folds higher risk of IFG. In addition, studies conducted in Vietnam and Nigeria revealed that those who were smokers had up to 2.6 and 4.39 folds higher risk of pre-diabetes state, respectively.[13,16]

In general, one reason for non-significant relationships found in the present study has been declared by Davidson et al. They assumed that lowering the criterion for IFG will not provide clinical benefits.[27] In addition, two studies found that the ADA criterion for IFG definition did not appear to have enhanced ability to predict diabetes and the incidence of cardiovascular diseases compared to the original IFG definition.[26] It can be supposed that in this plasma glucose level, lifestyle risk factors haven't been changed significantly in our population but their higher frequencies may be a notification to be considered in future researches. Consequently, our results confirmed our null hypothesis that there is no significant difference in lifestyle patterns between IFG cases and controls.

Several limitations of this study need to be kept in mind. Firstly, since our study was conducted in the morning due to FPG sampling, many employed men

could not attend and women subjects were in larger numbers. Secondly, this was a cross-sectional investigation and it was difficult to determine the contribution of relevant risks to the occurrence of IFG. Future studies need to be conducted in cohort design with larger sample sizes.

Conclusion

Although there was no significant association between lifestyle risk factors and IFG, the frequency of risk factors in the cases was higher than the controls. In general, considering the ADA criterion, the non-significant results were justifiable. Eventually, large multi-centre follow-up studies or interventional studies are needed to further explore the subject.

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