Turkish Journal of Endocrinology and Metabolism, (2000) 2 : 63-66 **ORIGINAL ARTICLE**

A Comparison Between the American Diabetes Association Criteria and World Health Organization Criteria in the Diagnosis of Glucose Intolerance

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The American Diabetes Association (ADA) published new diagnostic criteria and changed the fasting plasma glucose (FPG) diagnostic cut point from 140 mg/dl to 126 mg/dl for diabetes in 1997. This study was designed to compare the ADA criteria with the WHO criteria. We had performed an epidemiological study in 1994 on 1452 subjects. We could not obtain the records of four subjects and reviewed the records of 1448 subjects retrospectively. Forty seven (3.2%) versus 41 (2.8%) subjects were diagnosed with diabetes using the ADA and the WHO criteria, respectively. If FPG levels are considered as the main means of diagnosis and the cut point is reduced from 140 to 126 mg/dl the prevalence of diabetes is 2.5%, and 11 cases (0.7%) not have a diagnosis of diabetes. Of the 132 (9.1%) subjects diagnosed with glucose intolerance (IGT) according to the WHO criteria, 128 (8.8%) have IGT and 4 (0.3%) have diabetes according to the ADA criteria. Of the 1217 (84%) subjects with normal glucose tolerance (NGT) according to the WHO criteria, 1191 (82.2%) have NGT, 24 (1.7%) impaired fasting glucose (IFG), and 2 (0.1%) diabetes according to the ADA criteria. The present study showed that FPG level as a predictor of developing diabetes was important. In addition, we consider that 2-h plasma glucose (PG) level assessments must be performed.

Key words: Diabetes Mellitus, epidemiology, diagnostic criteria, prevalence

Introduction

The most widely used diagnostic criteria for diabetes mellitus (DM) and glucose intolerance (IGT) are those of the World Health Organisation (WHO). These criteria were based on a level of fasting plasma glucose (FPG) of ≥140 mg/dl on more than one occasion and/or a 2-h post oral glucose tolerance test (OGTT) plasma glucose (PG) level of ≥200 mg/dl (1,2). But, epidemiological studies suggest that the level of FPG associate with an increased risk of developing complications in diabetes is closer to 126 rather than to 140 mg/dl (1,3,4). Therefore, in 1995, an international expert committee was established to review the literature since 1979. According to the report of this committee, the American Diabetes Association (ADA) published new diagnostic criteria for diabetes in 1997. These new criteria changed the FPG diagnostic cut point from 140 to 126 mg/dl (5).

The aim of the present study was to compare the 1997 ADA criteria with the 1985 WHO criteria with respect to the prevalence of diabetes in a population-based study of 1448 subjects performed in Central Anatolia.

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Material and Methods

The study population was located in the city of Kayseri in central Anatolia. Besides the relatively modern lifestyle with industrialisation and urbanisation, the customary style of nutrition was high in calories, the diet being rich in fat and carbonhydrates. In this population, we had performed an epidemiological study in 1994 on 1452 subjects (6). Of the 1452 subjects, 58 (4.0%) had diagnosed, 41 (2.8%) undiagnosed diabetes and 132 (9.1%) IGT according to WHO criteria. Since we could not obtain the records of four subjects, we retrospectively reviewed 1448 of these 1452 subjects, according to ADA criteria and WHO criteria. The WHO criterion for diabetes was FPG≥140 mg/dl or 2-h PG≥200 mg/dl during an OGTT, and the ADA criterion was FPG≥126 mg/dl or 2-h PG≥200 mg/dl during an OGTT. The Expert Committee of ADA recognizes an intermediate group of subjects whose glucose levels do not meet the criteria for diabetes but are high enough to be considered as abnormal. This group is defined as having impaired fasting glucose, with FPG≥110 mg/dl but <126 mg/dl or 2-h PG values in the OGTT≥140 mg/dl but <200 mg/dl (5, 7, 8).

The subjects were divided into 7 subgroups according to levels of initial FPG and 2-h PG, such as no DM (WHO)/No DM (ADA), IGT (WHO)/IGT (ADA), No DM (WHO)/IFG (ADA), IGT (WHO)/IFG (ADA), No DM (WHO)/DM (ADA), IGT (WHO)/ DM (ADA), and DM (WHO)/DM (ADA).

Statistical Analysis

To examine the agreement between the two diagnostic criteria, a cross-table (Cohen's Kappa Test) was made. The k value was calculated. A value of 1 indicates perfect agreement, and a value of 0 indicates that there is no agreement. Risk factors and metabolic characteristics were compared among all groups. Differences were tested with analysis of covariance for continuous variables, adjusted for age and sex. Chi-square test was performed to compare the ratio of hypertension and sex between all groups. Student-t test and Mann Whitney U test were used to compare the age among groups. All analyses were performed using the Statistical Package for the Social Sciences (SPSS) for Windows 7.0. All results are given as means±SD and a p value <0.05 is considered significant.

Results

The study population consisted of 603 men with a mean age of 47.35±11.37 years and 845 women with a mean age of 44.88±11.58 years. All subjects were evaluated according to both the ADA criteria and the WHO criteria (Table 1). The prevalence of diagnosed DM was 4% according to WHO criteria Forty seven (3.2%) versus 41 (2.8%) subjects were diagnosed with diabetes using the ADA and the WHO criteria, respectively. Of the 132 (9.1%) subjects dignosed with IGT according to the WHO criteria, 128 (8.8%) also have IGT, and 4 (0.3%) have diabetes according to the ADA criteria. Of the 1217 (84%) subjects with NGT according to the WHO criteria, 1191 (82.2%) have NGT, 24 (1.7%) IFG, and 2 (0.1%) have diabetes according to the ADA criteria. If FPG levels are taken as the main means of diagnosis and the cut point is reduced from 140 to 126 mg/dl, then the prevalence of undiagnosed diabetes mellitus is 2.5% (36 cases) and 11 cases (0.8%) do not have diabetes. To examine the agreement between the two sets of criteria, a cross-table (Kappa sets) was made. If FPG and 2-h PG are used to diagnose diabetes, the agreement is 98% (κ: 0.980). But, if FPG is used only, then the agreement is 49 % (κ: 0,490).

Table 1. The prevalences of diabetes and glucose intolerance according to te ADA criteria and the WHO criteria.

	NGT (WHO)	IGT (WHO)	Undiagnosed Diabetes (WHO)	Diagnosed Diabetes	Total
NFG (ADA)	1191 (82.2)	-	-	-	1191 (82.2)
IFG (ADA)	24 (1.7)	-	-	-	24 (1.7)
IGT (ADA)	-	128 (8.8)	-	-	128 (8.8)
Undiagnosed diabetes (ADA)	2 (0.1)	4 (0.3)	41 (2.8)	-	47 (3.2)
Diagnosed diabetes	-	-	-	58 (4.0)	58 (4.0)
Total	1217 (84.0)	132 (9.1)	41 (2.8)	58 (4.0)	1448

Table 2. Comparisons of some parameters between diabetic and non diabetic subjects grouped according to WHO and ADA criteria.

	No DM (WHO)/ No DM (ADA)	IGT (WHO)/ IGT (ADA)	No DM (WHO)/ IFG (ADA)	No DM or IGT WHO/ DM (ADA)	DM (WHO)/ DM (ADA)
n	1191	128	24	6	41
Age (years)	44.61±11.13ψΩ	55.50±11.99ψ	47.91±10.42	49.67±11.41	51.85±13.15Ω
Sex (% men)¥	42.4	35.7	34.8	50.0	43.9
Hypertension (%)@	31.8	42.6	47.8	50.0	51.2
BMI (kg/m^2)	29.03±5.08*#	29.94±4.90*	30.24±3.85	27.32±4.23φ	30.74±4.47#φ
Cholesterol (mmol/l)	192.37±37.19	193.97±38.78	189.56±29.80	180.80±23.70	198.77±39.36
HDL (mml/l)	44.69±8.97	44.26±8.82	46.00±9.93	41.20±9.12	43.57±8.83
TG (mmol/l)	134.16±81.90*Ωψ	159.57±127.78*	205.50±114.22#ψ	90.20±41.12#φ	200.65±124.16φ

(*, #, φ $p<0.05$) (Ω, ψ $p<0.0001$) (¥ $x^2=2904$ $p>0.05$)

(@ $x^2=15.250$ $p<0.005$; lower in No DM/No DM group than the rest)

Some risk factors, adjusted for age and sex, were compared among the concordant diabetic group, concordant non-diabetic group and discordant groups (Table 2). Total cholesterol and HDL cholesterol of all groups were similar. But, triglyceride was significantly lower in the No DM/No DM group compared to the IGT/IGT, No DM/IFG, and DM/DM groups ($p<0.05$; <0.05; <0.0001; respectively). Body mass index (BMI) was significantly higher in the DM/DM and IGT/IGT groups compared to the No DM/No DM group ($p<0.05$, <0.05, respetively). The rate of hypertension was significantly lower in the No DM/No DM group compared to the other groups ($x^2=15.250$, $p<0.005$). The No DM/No DM group was younger than the IGT/IGT and DM/DM groups ($p<0.0001$, <0.0001, respectively). Sex (% men) was similar in all groups.

Discussion

Harris et al. recently studied the consequences of using the ADA criteria in the National Health and Nutrition Examination Survey (NHANES) III population. They found that the new diagnostic criteria will increase the number of individuals with diagnosed diabetes (undiagnosed diabetes was 4.4% when using the ADA criteria, and 6.4% using the WHO criteria) (7). In the Hoorn stuy, de Vegt et l. found that 18.9% of subjects shifted to another glucose intolerance group when applying the ADA criteria, compared to WHO criteria, without affecting the overall prevalence of diabetes (8). But, both Harris and de Vegt had used only the FPG for diagnosis of diabetes. So, the agreement between the ADA criteria and the WHO criteria was found to be poor (7,8). In a sub-population, with repeated measurements, when the diagnostic criteria of the ADA and the WHO were applied to the means of the duplicate FPG and 2-h PG values, de Vegt et al. observed that duplicate measurements improved the agreement (8). Dinneen et al. showed that the level of FPG was a major determinant of an individual's subsequent risk of developing diabetes (9). Gary et al. also showed that an FPG cut off value of 7.8 mmol/l had a low sensitivity for the diagnosis of diabetes (1).

In this study, we analysed the consequences of using the Ada criteria instead of WHO criteria with respect to the prevalence of glucose intolerance and some risk factors. We used both FPG and 2-h PG to diagnose diabetes. We found the prevalence of undiagnosed diabetes as 47 (3.2%) using ADA criteria and as 41 (2.8%) using the WHO criteria. If FPG levels are the main means of diagnosis and if the cut point is reduced from 140 to 126 mg/dl, then prevalence of diabetes is 2.5% (36 cases) and 11 cases (0.8% of all subjects and 23 % of undiagnosed diabetes) are not diagnosed with diabetes. If FPG and 2-h PG are used to diagnose diabetes, the agreement is 98% (κ: 0.980). But, if only FPG is used, then the agreement is 49% (κ: 0.490). So, 2-h plasma glucose levels should be taken into consideration for diagnosis of diabetes. In our

study, of the 132 (9.1%) subjects diagnosed with IGT according to the WHO criteria, 128 (8.8%) also had IGT, and 4 (0.3%) had diabetes according to the ADA criteria. Of the 1217 (84%) subjects with NGT according to the WHO criteria, 1191 (82.2%) had NGT, 24 (1.7%) IFG, and 2 (0.1%) had diabetes according to the ADA criteria. Compared to the WHO criteria, 10.9% of all subjects shifted to another glucose intolerance group when using the ADA criteria.

In conclusion, our retrospective study showed that FPG level as a predictor of developing diabetes is important. Also, we propose the measuring of 2-h PG levels additionally, in contrast to previous reports suggesting only FPG measurement.

Referances

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