Fast eating and the risk of type 2 diabetes mellitus: A case-control study

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ARTICLE INFO

Article history:
Received 1 February 2012
Accepted 22 June 2012

Keywords:
Eating speed
Type 2 diabetes mellitus
A case-control study

SUMMARY

Background & aim: The aim of the study was to assess the relationship between eating speed and the risk of type 2 diabetes mellitus.

Subjects and methods: A case-control study included 234 cases with newly diagnosed type 2 diabetes and 468 non-diabetic controls. A specifically designed questionnaire was used to collect information on possible risk factors of type 2 diabetes. The speed of eating was self-reported by study subjects compared to other subjects, with whom they were eating at the same table. The odds ratios (OR), and 95% confidence intervals (95% CI) for type 2 diabetes were calculated by a conditional logistic regression.

Results: Variables such as a family history on diabetes, body mass index, waist circumference, educational level, morning exercise, smoking and plasma triglycerides level were retained in multivariate logistic regression models as confounders because their inclusion changed the value of the OR by more than 5% in any exposure category. After adjustment for possible confounders more than two-fold increased risk of type 2 diabetes was determined for subjects eating faster (OR = 2.52; 95% CI 1.56–4.06) vs. subjects eating slower.

Conclusions: Our data support a possible relationship between faster eating speed and the increased risk of type 2 diabetes mellitus.

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1. Introduction

Diabetes mellitus is one of the main public health issues. It is becoming a world pandemic. The estimated diabetes prevalence for 2011 has risen to 366 million, representing 8.5% of the world’s adult population, with a prediction that by 2030 the number of people with diabetes will have risen to 552 million.1 85–95% of people with diabetes have type 2 diabetes.2 In Lithuania, state located on the southeast coast of the Baltic Sea with an area of 65,200 km² and population of 3,349,872 estimated in the beginning of 2009, the prevalence of type 2 diabetes mellitus among 35–64 year-aged Lithuanian inhabitants raised from 2.30% in 1987 to 5.00% in 2004.3–5 The type 2 diabetes appears to involve interaction between susceptible genetic backgrounds and environmental factors including highly calorific diets. It’s important to identify modifiable risk factors for type 2 diabetes mellitus, which may help reduce the risk of the disease by means of prevention.

For the meantime in scientific literature we had not found data about eating speed as risk factor for type 2 diabetes mellitus. Therefore the aim of the study was to assess the relationship between eating speed and the risk of type 2 diabetes mellitus.

2. Subjects and methods

A case-control study has been carried out at outpatient clinic in Kaunas, Lithuania. The study included 234 cases aged 35–86 years with newly confirmed diagnosis of type 2 diabetes mellitus according to the criteria of World Health Organization (WHO) during the one whole year.6 In total 468 control subjects who neither had impaired fasting glucose level nor type 2 diabetes mellitus after glucose tolerance test were recruited from the patients of the same clinic. They were individually statistically matched to the diabetic patients by gender and age (±5 years). Ratio of cases and controls was 1:2.

Information on age, gender, family history on diabetes, education, marital status, nutrition habits, cigarette smoking and physical activity assessed by a special questionnaire designed by our research group. All subjects (cases and controls) were asked to fill questionnaire themselves. If there were some reasons why they were not able to do that (bad general condition, poor vision,
pathology of upper extremities or personal wish for assistance to fill up a questionnaire) they were interviewed by interviewers. Two interviewers were trained and were not aware of the study hypothesis.

Participants were asked to fast for 12 h and to avoid smoking and heavy physical activity for at least 2 h before the examinations. Anthropometrical measurements were made according to the guidelines of WHO.7 Height and weight measured twice. Height measured without shoes in centimetres (0.1 cm accuracy). Weight measured with light clothing in kilogrammes (0.5 kg accuracy). Body mass index (BMI) calculated as weight (kg)/height (metres) squared.8 Waist circumference (WC) measured by holding the non-stretchable measuring tape snugly around the waist, defined as the midpoint between the bottom rib and tip of the hipbone, and hip circumference measured at the level of great femur trochanter in centimetres (0.1 cm accuracy).

Laboratory blood tests included fasting blood samples drawn from subjects elbow vein and venous plasma samples analyzed for glucose and triglycerides (TG) levels. Venous plasma glucose estimated by the GOD--PAP method (Epindorf analyser, Germany). According to the recommendations of WHO (WHO 1999) 75-g oral glucose tolerance tests for the assessing carbohydrate disorders were performed and evaluated in the study subjects. TG was estimated by the GPO–PAP method (Randox analyser, UK).

The speed of eating was self-reported by study subjects compared to other subjects, with whom they were eating at the same table. Eating speed was estimated by answers (very slowly, relatively slower, the same as other subjects, relatively faster, very fast) to a question "How you are eating compare to other subjects?"

## Table 1
Characteristics of cases and controls.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Cases</th>
<th>Controls</th>
<th>P value for $\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Males</td>
<td>66 28.21</td>
<td>132 28.21</td>
<td>Matched</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>168 71.79</td>
<td>336 71.79</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>≤44</td>
<td>12 5.13</td>
<td>22 4.70</td>
<td>Matched</td>
</tr>
<tr>
<td></td>
<td>45–54</td>
<td>21 8.97</td>
<td>44 9.40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>55–64</td>
<td>90 38.46</td>
<td>178 38.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥65</td>
<td>111 47.44</td>
<td>224 47.86</td>
<td></td>
</tr>
<tr>
<td>Education (years of education)</td>
<td>≤10</td>
<td>115 49.15</td>
<td>157 33.55</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11–13</td>
<td>70 29.91</td>
<td>192 41.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;14</td>
<td>49 20.94</td>
<td>119 25.43</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Marital status</td>
<td>Married</td>
<td>137 58.55</td>
<td>296 63.25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Divorced/separated</td>
<td>127 55.56</td>
<td>250 51.66</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>6 2.44</td>
<td>16 3.26</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Widowed</td>
<td>68 29.06</td>
<td>107 22.86</td>
<td>0.497</td>
</tr>
<tr>
<td>Family history on diabetes</td>
<td>First-degree relatives without family history on diabetes</td>
<td>166 70.94</td>
<td>422 90.17</td>
<td></td>
</tr>
<tr>
<td></td>
<td>First-degree relatives with positive family history on diabetes</td>
<td>68 29.06</td>
<td>46 9.83</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>≤24.9</td>
<td>21 8.97</td>
<td>124 26.50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25–29.9</td>
<td>57 24.36</td>
<td>185 39.53</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥30</td>
<td>156 66.67</td>
<td>159 33.97</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

The categories — very slowly and relatively slower compared to other subjects of self-reported eating speed were grouped into one category, as well as categories — relatively faster and very fast — into another category.

BMI was grouped according to those who were 18.5–24.9 kg/m², 25–29.9 kg/m², and ≥30 kg/m².9

WC grouped according to those who were less than 80 cm for females and less than 94 cm for males, 80–88 cm for females and 94–102 cm for males, greater than 88 cm for females and greater than 102 cm for males.10,11

Family history on diabetes mellitus divided into categories of first-degree relatives with family history on diabetes and of first-degree relatives without family history on diabetes.

Level of education (number of years) divided into categories ≤10 years, 11–13 years, >14 years.

Smoking was assessed according to smoking habits: non-smoker, ex-smoker, infrequent smoker, current smoker.

Morning exercise of at least 30 min duration during the last 12 months was evaluated according self-reported answers: no, sometimes, yes.

Plasma TG was grouped as <1.7 (mmol/L) and ≥1.7 (mmol/L).

A conditional logistic regression was used to calculate the odds ratio (OR) and corresponding 95% confidence interval (CI) for diabetes mellitus in relation to exposures of interest. Variables were retaining in models as confounders when their inclusion changed the value of the OR by more than 5% in any exposure category.

All reported trend test significance levels ($P$ values) were two-sided.12 The differences between proportions were calculated using the $\chi^2$ test. The level of significance was set at 5%. All the calculations were performed with the standard STATA 7 software program.

## 3. Results

Characteristics of type 2 diabetic patients and of the control group contingent are displayed in Table 1. In our study there were 28.21% men and 71.79% women. The mean age was 64.09 years (SD = 7.85) (range: 39–86 years) for men and 65.23 years (SD = 8.3) (range: 34–86 years) for women. The cases — type 2 diabetic patients had significantly lower education level, compared to controls. Their body mass index was higher than in controls. There were more controls without a family history of a first degree relative with diabetes than cases.

Univariate regression showed that subjects who were eating faster compared to those eating slower were related to the higher risk of type 2 diabetes mellitus (crude OR = 2.50; 95% CI 1.69–3.68, $P < 0.001$).

Variables such as a family history on diabetes, body mass index, waist circumference, educational level, morning exercise, cigarette smoking and plasma triglycerides level were retained in multivariate logistic regression models as confounders because their inclusion changed the value of the OR by more than 5% in any exposure category. Data of multivariate logistic regression showing relationship between type 2 diabetes mellitus and eating speed are presented in Table 2. Firstly, after adjusting for a family history on

## Table 2
Odds ratios and 95% confidence interval for diabetes mellitus in relation to eating speed.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Cases</th>
<th>Controls</th>
<th>OR* (95% CI) P</th>
<th>OR** (95% CI) P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating speed compare to other</td>
<td>Slower</td>
<td>60 25.64</td>
<td>191 30.41</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td>The same</td>
<td>44 18.80</td>
<td>103 15.80</td>
<td>1.37 (0.76–2.41)</td>
<td>1.66 (0.91–3.03)</td>
</tr>
<tr>
<td></td>
<td>Faster</td>
<td>130 55.56</td>
<td>174 37.18</td>
<td>2.26 (1.44–3.55)</td>
<td>2.52 (1.56–4.06)</td>
</tr>
</tbody>
</table>

Eating speed OR* adjusted for family history on diabetes, educational level, BMI and waist circumference; OR** adjusted for family history on diabetes, educational level, BMI, waist circumference, smoking, morning exercise and plasma TG level.
were asked to eat as quickly as possible. The women ate until they
anorexigenic gut peptides and favors earlier satiety.18 If food is
meal over 30 min instead of 5 min leads to higher concentrations of
in Kingston, 30 women were asked to eat a pasta-based meal under
completion. In a 2007 US study from the University of Rhode Island
to be a key correlate of a cluster of diabetogenic, atherogenic,
level, morning exercise, cigarette smoking and plasma triglycerides
in excess risk of type 2 diabetes because of eating speed changed
quickly and binge eating have been associated with satiety and
hormones, responsible for signalling that the body is full. Thus,
eaten rapidly, there may not be enough time for the secretion of
increased body weight and weight gain, that may lead to obesity
hungry
eating speed changed
self-reported speed of eating in
Our work has certain limitations that need to be acknowledged.
first weakness of the study is that the validity of self-reported
speed of eating was not evaluated by quantified measurement of
eating speed using objective methods, neither by comparison with
speed of eating as reported by friends. Second, the eating speed was
subjectively by determinable and self-reported by study subjects
and we cannot exclude reporting bias in the present study. Self-
reporting measurement may potentially lead to under-estimation
of eating speed as a separate risk factor for type 2 diabetes mellitus.
We used only 2 categories of eating speed (i.e. ‘slowly and
relatively slower’ and ‘relatively faster and very fast’) due to small
sample size. Another limitation is that analyses did not control
energy intake. Validation studies of self-reported speed of eating in
comparison with careful quantified measurements of eating rate
would be useful.

4. Discussion
The present study has demonstrated that subjects who were
eating faster compare to those eating slower were associated with
the higher risk of type 2 diabetes mellitus. Gorging and eating
quickly have been associated with total energy intake, and eating
quickly and bing eating have been associated with satiety and
insulin resistance.13–16 Grabbing a quick lunch has almost become
a way of life, when it is necessary to hurry. Energy intake was lower
when the meal was eaten slowly, and satiety was higher at meal
completion. In a 2007 US study from the University of Rhode Island
in Kingston, 30 women were asked to eat a pasta-based meal under
two distinct conditions: At one sitting, they were asked to take
small bites and chew each one 15–20 times. At another sitting, they
were asked to eat as quickly as possible. The women ate until they
were satisfied. Compared to the ‘speed-eaters’, the ‘slow-eaters’
consumed about 70 kcal less and they also felt more satisfied
immediately after their meal and an hour later. This suggests that
‘going hungry’ and the ‘speed-eating’ that follows can easily allow
you to eat much more than is necessary.17 Short study of seventeen
healthy adult male volunteers demonstrates that eating the same
meal over 30 min instead of 5 min leads to higher concentrations of
anorexigenic gut peptides and favors earlier satiety.18 If food is
eaten rapidly, there may not be enough time for the secretion of
hormones, responsible for signalling that the body is full. Thus,
the higher risk of type 2 diabetes mellitus. Gorging and eating
eating faster compare to those eating slower were associated with

5. Conclusions
Our data support a possible relationship between faster eating
speed and the increased risk of type 2 diabetes mellitus.

A short page-heading
For the meantime no data in scientific literature or eating speed
could influence on the risk of developing type 2 diabetes mellitus.
Our data support a possible relationship between faster eating
speed and the increased risk of type 2 diabetes mellitus.

Sources of funding
This research received no specific grant from any funding
agency in the public, commercial or not-for-profit sectors.

Conflict of interest
No conflict of interest was declared.

Acknowledgements
We hereby express sincere thanks to staff of Kaunas Dainavos
Outpatient clinic for affable conditions for our study.

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