Clinical Nutrition 32 (2013) 481–484

Contents lists available at SciVerse ScienceDirect

Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

Short communication

White rice consumption and risk of type 2 diabetes

Federico Soriguer [a,b,c,d,*], Natalia Colomo [a,b,e], Gabriel Olveira [a,b,c], Eduardo García-Fuentes [a,b,d], Isabel Esteva [a,b,c], María Soledad Ruiz de Adana [a,b,c], Sonsoles Morcillo [c,f], Nuria Porras [a,b,c], Sergio Valdés [a,b,c], Gemma Rojo-Martínez [a,b,c,d]

[a] Endocrinology and Nutrition Department, Hospital Universitario Carlos Haya, Málaga, Spain
[b] Instituto de Investigaciones Biomédicas de Málaga (IBIMA), Málaga, Spain
[c] Spanish Biomedical Research Centre in Diabetes and Associated Metabolic Disorders (CIBERDEM), Spain
[d] Spanish Biomedical Research Centre in Obesity and Nutrition (CIBEROBN), Spain
[e] Río Hortega, Clinical Research Program of the Instituto de Salud Carlos III, Spain
[f] Endocrinology and Diabetes Research Group, Hospital de Cruces and University of the Basque Country School of Medicine, Bilbao, Spain

ARTICLE INFO

Article history:
Received 25 May 2012
Accepted 8 November 2012

Keywords:
Type 2 diabetes
Rice intake
Olive oil

SUMMARY

Background & aim: Recent studies suggest that white rice consumption increases risk of diabetes. Aim: to assess the association between white rice intake and the incidence of diabetes in a population from Southern Spain.
Methods: A population-based cohort study was undertaken in Pizarra, Spain. At baseline and follow-up, participants underwent an interview and a standardized clinical examination which included an oral glucose tolerance test in those subjects without known diabetes. Incidence and odds ratio (OR) for diabetes were calculated. Multivariate analysis was performed using stepwise logistical regression.
Results: Thirty eight percent of subjects reported rice consumption 2–3 times a week, 58.5% once or less a week, and 3.6% no rice consumption. In subjects who reported rice intake 2–3 times a week, incidence of diabetes after 6 years follow-up was 12.0%, and in those who reported once or less a week, 20.2% ($p = 0.04$, non adjusted). Subjects who ate rice frequently had lower risk to develop diabetes 6 years later (OR = 0.43, $p = 0.04$; adjusted for age, sex, obesity, and presence of impaired fasting glucose and/or impaired glucose tolerance at baseline).
Conclusions: A negative association was found between white rice intake in the way it is consumed in Southern Spain, and the 6 years incidence of diabetes.

1. Introduction

The prevalence of type 2 diabetes (T2DM) is increasing rapidly worldwide. Although lifestyle characteristics such as obesity and physical activity are established risk factors for diabetes, less is known about dietary factors. The quality of carbohydrates has received particular interest because it can influence the digestion rate and thus the blood glucose response.[1] Although previous studies suggest that diets with a high glycemic index (GI) or glycemic load, are associated with an increased risk of developing T2DM,[2] the role of GI in the prevention of diabetes remains controversial.

Hu et al,[3] in a recent meta-analysis which included seven prospective cohort studies in Asian and Western populations, report that high white rice consumption is associated with a significantly increased risk of type 2 diabetes, especially in Asian (Chinese and Japanese) populations.

The aim of the present study is to assess the association between white rice intake and the incidence of T2DM within the Pizarra study, a prospective population-based study undertook in Southern Spain.[4]

2. Methods

2.1. Population

The Pizarra study is a prospective, population-based study undertaken in Pizarra, an inland town of 6600 inhabitants (5000 aged 18–65 years old) located some 30 km from the city of Malaga,

Abbreviations: T2DM, type 2 diabetes mellitus; GI, glycemic index; BMI, body mass index; FFQ, food frequency questionnaire; OGTT, oral glucose tolerance test; AGR, abnormal glucose regulation; OR, odds ratio; SFA, saturated fatty acids; MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids.

* Corresponding author. Department of Endocrinology and Nutrition, Hospital Universitario Carlos Haya, Plaza del Hospital Civil, 29009 Malaga, Spain. Tel./fax: +34 952286704.
E-mail address: federico.soriguer.sspa@juntadeandalucia.es (F. Soriguer).

0261-5614/$ – see front matter
http://dx.doi.org/10.1016/j.clnu.2012.11.008

in Southern Spain. The study characteristics have been reported in detail elsewhere.[4,5] Participants were selected randomly from the municipal census. Exclusion criteria included people who were institutionalized, pregnant women and persons with a severe clinical problem or psychological disorder.

The baseline study was undertaken during 1997–1998. Out of the eligible adults, 70.3% ($n = 1051$) were attended for examination. The final sample distribution by age and sex was not significantly different to the distribution of the general population.

The cohort was re-evaluated 6 years later in 2003–2004. Persons who had completed the baseline study and were not diagnosed with T2DM ($n = 910$) were invited by letter or by phone to attend another examination. Seven hundred and fourteen subjects completed the 6-year follow-up study (participation rate was 78.5%).

The protocol was approved by the Ethics and Clinical Research Committee of Carlos Haya Hospital. All participants provided written informed consent.

2.2. Procedures

Both at baseline and at follow-up, all participants underwent an interview and a standardized clinical examination. The same methodology was used for both the baseline and the follow-up studies.

Data were recorded on education, smoking, and the degree of physical exercise.

Measurements were made of weight and height, and body mass index (BMI) was calculated as weight in kg divided by height in square meters. BMI equal to or higher than 30 kg/m^2 was considered obesity.

At baseline, a food frequency questionnaire (FFQ) was administered to 605 participants. Between those participants, 554 persons completed also a prospective, 7 days quantitative food questionnaire at two different times during the year. We used questionnaires previously validated in a similar population.[6] The surveys were given by experienced dietitians previously trained for this project. After making an appointment by telephone, the dietitians handed over the questionnaire in the home of the participant and provided information about the nature of the survey. Photographs were used for determinate portion sizes. The transformation to energy and macronutrients was done by a computer program that included the composition of local foods based on food composition studies, previously done by some of the authors.[6]

A fasting blood sample and an oral glucose tolerance test (OGTT) were drawn at baseline and at the follow-up in those subjects without known diabetes. Serum was stored at −80°C for later analysis. Diabetes was diagnosed and classified according to the 1998 World Health Organization criteria. Abnormal glucose regulation (AGR) was defined as the presence of impaired fasting glucose and or impaired glucose tolerance.

2.3. Statistical analysis

Continuous variables are presented as the mean and standard deviation, categorical variables as percentages. Incidence and odds ratio (OR) for diabetes were calculated for the exposure variable, and 95% confidence intervals were computed. Multivariate analysis was performed using stepwise logistical regression. In all cases the level of rejection of a null hypothesis was $\alpha = 0.05$.

3. Results

3.1. Nutritional assessment

Of 605 subjects to whom a FFQ was administered at baseline, 37.9% ($n = 229$) reported rice consumption 2–3 times a week, 58.5% ($n = 354$) once or less a week, and 3.6% ($n = 22$) declared no rice consumption.

At baseline, neither age (39.7 ± 131.8) nor sex (61.4% women) was significantly different between subjects with different rice intake patterns. After adjustment for age and sex, the prevalence of obesity (28.0%), AGR (27.6%) and T2DM (18.5%) did not differ between subjects with different rice intake.

Estimate of total energy intake was 2627.3 ± 714.25 kilocalories/day in men, and 1956.3 ± 570.90 kilocalories/day in women ($p < 0.0001$). Daily carbohydrates consumption was 248.11 ± 94.58 g/day (44.76 ± 6.68% of total energy intake), daily proteins consumption was 83.38 ± 25.85 g/day (15.51 ± 3.10% of total energy intake), and daily lipids consumption was 99.93 g/day (41.12 ± 5.88% of total energy intake). Monounsaturated fatty acids (MUFA) represent 18.19 ± 4.17% of total energy intake. Table 1 shows total energy intake, carbohydrates, protein and lipids consumption, included MUFA, polyunsaturated fatty acids (PUFA) and saturated fatty acids (SFA), based on the frequency intake of white rice. It is remarkable that MUFA intake was significantly higher in those subjects who took more white rice.

In Table 2, the intake some foods included in the food frequency questionnaire, physical activity and educational level based on white rice consumption are described. Pasta intake was significantly lower ($p = 0.00001$) in the group of subject who ate rice more frequently. However, legume intake was significantly higher in that group ($p = 0.0001$). Neither olive oil consumption, nor educational level, nor physical activity was different taking into consideration the frequency of rice consumption.

3.2. Diabetes incidence

Of all participants to whom a FFQ was administered and had not diabetes at baseline, in 54 subjects (17.1%) diabetes was diagnosed six years later.

In subjects who reported rice intake 2–3 times a week, incidence of diabetes after a 6 years follow-up was 12.0% ($n = 14$); however, subjects who reported rice consumption once or less a week had a diabetes incidence after 6 years follow-up of 20.2% ($n = 40$) ($p = 0.04$, non adjusted).

Subjects who ate rice more frequently had lower risk to develop diabetes 6 years later (OR = 0.43, $p = 0.04$; model adjusted for age,

Table 1
Total energy intake, carbohydrates, protein and lipids consumption based on the frequency intake of white rice.

	White rice intake		
	Once or less a week	More than once a week	*p*
Total energy (kcal/day)	2143.1 ± 642.4	2424.8 ± 769.7	0.001
Carbohydrates total (g/day)	242.9 ± 87.8	279.6 ± 107.5	0.002
Carbohydrates (% of total energy intake)	44.8 ± 6.7	45.7 ± 6.5	0.3
Protein (g/day)	80.5 ± 23.3	89.8 ± 27.3	0.003
Protein (% of total energy intake)	15.3 ± 3.0	15.1 ± 2.5	0.5
Lipids (g/day)	97.2 ± 29.4	109.6 ± 35.3	0.002
Lipids (% total energy intake)	41.1 ± 5.7	40.9 ± 6.0	0.8
SFA (g/day)	23.6 ± 8.5	26.9 ± 9.9	0.004
SFA (% total energy intake)	9.9 ± 2.2	10.1 ± 2.4	0.6
MUFA (g/day)	42.5 ± 13.7	47.9 ± 16.9	0.005
MUFA (% total energy intake)	18.1 ± 3.7	17.9 ± 3.9	0.7
PUFA-ω3 (g/day)	1.0 ± 0.4	1.2 ± 0.6	0.02
PUFA-ω3 (% total energy intake)	0.4 ± 0.2	0.4 ± 0.2	0.9
PUFA-ω6 (g/day)	12.0 ± 5.6	13.6 ± 6.8	0.04
PUFA-ω6 (% total energy intake)	5.0 ± 1.7	4.9 ± 1.6	0.8

Data are presented as mean and standard deviation. ANOVA test.
SFA: saturated fatty acids; MUFA: monounsaturated fatty acids; PUFA: polyunsaturated fatty acids; kcal: kilocalories; g: grams.