Nutrición Hospitalaria

Nutr. Hosp. (2005) XX (5) 348-350
ISSN 0212-1611 • CODEN NUHOEQ
S.V.R. 318

Original

Low glycemic index lunch on satiety in overweight and obese people with type 2 diabetes

A. Jiménez-Cruz, Aaron Noriki Gutiérrez-González and M. Bacardi-Gascon

Nutrition Program. School of Medicine. Universidad Autónoma de Baja California. México.

Abstract

Several studies have shown that isocaloric diets have different effects on satiety. The aim of the present study was to compare the effect of lunches with different glycemic indexes (GI) in type 2 diabetics. Ten men and women with type 2 diabetes participated in the study. Subjects were given two experimental lunches with glycemic indexes of 43 and 88. Visual analogue rating scales were completed before and after each experimental meal periodically to record subjective feelings of satiety. Satiety Area Under the Curve was 1024 ± 160 mm after the low GI diet and 711 ± 190 mm after the high GI diet. Eating a lunch with a low GI index resulted in higher satiety perception. These results suggest the need to promote culturally based combined foods with high fiber and low GI. This approach might contribute to the prevention of obesity by increasing the perception of satiety while also improving metabolic control of diabetics. In addition, this is a low cost approach for people with limited financial resources.

(*Nutr Hosp* 2005, 20:348-350)

Key words: *Type 2 diabetes. Obesity. Satiety index. Glycemic index. Mexican style diet.*

COMIDA CON ÍNDICE GLUCÉMICO BAJO Y SACIEDAD EN GENTE OBESA Y CON SOBREPESO CON DIABETES MELLITUS DE TIPO 2

Resumen

Diversos estudios han demostrado que las dietas hipocalóricas tienen diferentes efectos sobre la saciedad. El objetivo de este estudio fue comparar el efecto de comidas con diferentes índices glucémicos (IG) en diabéticos de tipo 2. Diez hombres y mujeres con diabetes de tipo 2 participaron en el estudio. Se administró a los individuos dos comidas experimentales con índices glucémicos de 43 y 88. Se completaron periódicamente escalas analógicas visuales de gradación antes y después de cada comida experimental para registrar los síntomas subjetivos de saciedad. El área bajo la curva de saciedad fue 1.024 ± 160 mm tras la dieta con IG bajo y 711 ± 190 mm tras la dieta con IG alto. La ingestión de una comida con un IG bajo produjo una mayor sensación de saciedad. Estos resultados sugieren la necesidad de promocionar los alimentos combinados, con una base cultural, con un contenido elevado en fibra y un IG bajo. Este abordaje podría contribuir a la prevención de la obesidad aumentando la percepción de saciedad a la vez que aumenta el control metabólico de los diabéticos. Además, este abordaje tiene un coste bajo en gente con recursos económicos limitados.

(*Nutr Hosp* 2005, 20:348-350)

Palabras clave: *Diabetes de tipo 2. Obesidad. Índice glucémico. Índice de saciedad.*

Introduction

The risk of developing type 2 diabetes mellitus for Mexican-Americans is twice that for non-Hispanic whites[1, 2]. However, in Mexico very few studies have focused on the effect of the current food consumption on satiety of the Mexican-style diet. Because of limited health care resources, developing countries must develop low cost, highly accessible and culturally based ap-

Correspondencia: M. Bacardí-Gascón
Calzada Tecnológico s/n
Mesa de Otay, CP 22390
Tijuana, Baja California, México
E-mail: montserrat@uabc.mx

Recibido: 11-V-2005.
Aceptado: 15-VII-2005.

proaches to prevent and control obesity and diabetes. Diet might be a tool to meet those features. Additionally, diets based on traditional eating habits might increase adherence to diet and to nutrition intervention programs. This approach could be used to reinforce control and prevention programs at the individual and community level for both children and adults.

Holt and cols.[3] observed that larger particles of wheat were associated with lower glucose and insulin response and higher satiety. It has also been shown that high-fiber-containing foods and fiber supplements have a potent effect on satiety, while the consumption of refined foods increases insulin response and decreases satiety[4]. Ludwig (1999) pointed out that different studies have demonstrated a strong and inverse association between GI and satiety[5].

Several studies have shown that the consumption of specific macronutrients might have an important effect on the consumption of the amount of total food consumed at a particular time; high protein content foods might increase satiety, while low protein foods produce low satiety[6]. Fat and carbohydrates have different effects on satiety and to subsequent food intake[7-10]; additionally, energy intake is also associated with food density[11, 12].

Traditionally, the Mexican diet in rural areas as well as in low-income populations from urban areas is based on beans, tortillas, and some fruits and vegetables. In two previous studies, Mexicans with type 2 diabetes improved their lipid profile after a 3-week moderate GI Mexican-style diet[13] and improved glycosylated hemoglobin (A1C) and body mass index (BMI) after a 6-week low GI Mexican-style flexible diet[14]. Besides, Mexican style dishes have shown improvement of total cholesterol and LDL on patients with hyperlipidemia[15].

The aim of this study was to evaluate the effect of Mexican style dishes at lunchtime on overweight and obese people with type 2 diabetes.

Methods

Ten men and women aged between 30 and 60 yrs with type 2 diabetes. Criteria for inclusion were BMI > 27 kg/(m)^2, fasting blood glucose levels < 250 mg/dL, A1C < 9%. Criteria for exclusion were as follows: any medication likely to modify food intake or eating behavior, consumption of > 5 cigarettes or > 20 g of alcohol per day, dyspepsia, pregnant women, women on high performance training, or persons with any systemic disease. All subjects gave informed consent, and the study was approved by the Ethics Committee of the Graduate Program of Nutrition of the Autonomous University of Baja California.

Procedure

Subjects were asked to maintain their physical activity levels on the day before each test day as similar as possible. Subjects were also asked to refrain from drinking alcohol on the day before each test day and throughout each test day. The evening meal of the day before each test was designed to be a 700 kcal meal consumed between 8 p.m. and 10 p.m. On the day of the test, subjects were instructed to be transported by car or bus. Food and activity diaries were used to monitor compliance. On each test day, subjects were weighed and measured. The test meal was at Mexican lunchtime (3 p.m.). On each test day, participants were given a standard breakfast at 8:00 a.m. and a snack at 11:30 a.m. to control at least two consumption meals before the test meal.

At the start of the test meal, subjects rated their hunger and fullness on visual analogue scales. For example, hunger was rated on 100 mm line preceded by the question: "How hungry are you right now? and anchored on the left by "not at all hungry" and on the right by "extremely hungry". Ratings were performed before and after each test meal every 30 min for 4 hours. Each test meal was consumed with a 360 ml bottle of water during a period of 15 min. During the test period subjects were permitted to read magazines, excluding any articles related to food, body image or weight loss. Subjects could watch TV or listen to the radio.

Incremental areas under the response curves were calculated using the trapezoidal rule with fasting levels as the baseline. Any negative area was ignored. The SI of each meal was determined by the Wolever[16] formula for glycemic index.

Each experimental breakfast and lunch was randomly assigned. Test meals were assessed in a period no shorter than 15 days.

Diets

The total low GI diet contained 1796 kcal, 249 g carbohydrate, 85 g protein, 57 g fat, 36 g total fiber, with a GI of 62. The low GI lunch test contained 517 kcal, 29 g carbohydrate, 65 g protein, 15 g fat, 8 g fiber, and GI of 43. The total high GI diet contained 1776 kcal, 247 g carbohydrate, 80 g protein, 58 g fat, 35 g total fiber, with a GI of 83. The high GI lunch test contained 498 kcal, 27 g carbohydrate, 60 g protein, 16 g fat, 7 g fiber, and GI of 88.

Statistical analyses

Data were analyzed using SPSS for Windows (V.10). The incremental areas under the satiety response curves were calculated using the trapezoidal rule with fasting scores as the baseline[19]. Satiety area under the curve (SAUC) differences between meals were compared by Wilcoxon rank-test.

Results

All the participants (nine women and one man) completed the two experimental lunches. Mean age

was 37 yrs (range: 35-53), with a mean time of evolution of diabetes 3.8 yrs (range: 1-8), average BMI was 35.8 (27.8-45.8) kg/(m)^2, fasting blood glucose was 7.4 (range: 6.7-8.3) mmol/L, and A1C was 8.5%[8-9]. Nine participants were under pharmacological treatment, diet and exercise, and one was only under diet and exercise. SAUC was 1024 ± 160 mm after the low GI diet and 711 ± 190 mm after the high GI diet.

Discussion

The result of this study shown that the lowest GI combined lunch resulted in 30.5% higher satiety (p = 0.005). As in our study, Holt and cols.[17], in a study conducted with single foods reported a negative correlation between GI and satiety; and Ludwig (1999) observed 53% and 81% lower food intake after low GI breakfast and lunch respectively, when compared to intermediate and high GI foods.

Holt (1996) did not find an association between glucose AUC and satiety scores; nonetheless, sweet bread and rolls showed the highest insulin and glucose index and the lowest satiety[11]. Stubbs and cols.[12] pointed out that more than 26 studies have shown that complex carbohydrates have the highest effect for reducing hunger and limiting the subsequent consumption of energy. In the study conducted by Buyken and cols.[18] an association was observed between low GI foods, with low AIC. In this study we were able to control the consumption of calories, carbohydrates, protein, and fiber, thus the effect on satiety was independent of the nutrient and fiber content of a mixed meal. Our results suggest that changing the GI of combined foods with culturally based diets in Mexico, increases the perception on satiety. Therefore, low GI and high SI diets might be a low cost approach for the control of Mexican people with diabetes and obesity.

References

1. Harris LI: Diabetes in America: epidemiology and scope of the problem. *Diabetes Care* 1998; 21(Supl. 3): C11-C14.
2. Harris CL, Hewett-Emmett D, Bertin TK and Schull WJ: Origins of US Hispanics: implications for diabetes. *Diabetes Care* 1991; 14(Supl. 3): 618-627.
3. Holt SHA and Brand Miller J: Particle size, satiety and the glycaemic response. *Eur J Clin Nut* 1994; 48: 496-502.
4. Holt SHA, Brand Miller JC, Petocz P and Farmakalidis EA: satiety index of common foods. *Eur J Clin Nut* 1995; 49: 675-690.
5. Ludwig DS, Majzoub JA, Al-Zahrani A, Dallal GE, Blanco I and Roberts SB: High glycemic index foods, overeating and obesity. *Pediatrics* 1999; 103: 261-266.
6. Roger PJ and Blundell JE: Mechanism of diet selection: the translation of needs into behaviour. *Proc Nut Soc* 1991; 50(1): 65-70.
7. Lawton CL, Burley VJ, Wales JK and Blundell JE: Dietary fat and appetite control in obese subjects: weak effects on satiation and satiety. *Int J Obesity* 1993; 17(7): 409-416.
8. Green SM and Blundell JE: Effect of fat-and sucrose-containing foods on the size of eating episodes and energy intake in lean dietary restrained and unrestrained females: potential for causing overconsumption. *Eur J Clin Nut* 1996; 50(9): 625-635.
9. Rolls BJ and Bell EA: Intake of fat and carbohydrates: role of energy density. *Eur J Clin Nut* 1999; 53(Supl. 1): S166-S173.
10. Marmonier C, Chapelot D and Sylvestre L: Effects of macronutrient content and energy density of snacks consumed in a satiety state on the onset of the next meal. *Appetite* 2000; 34: 161-168.
11. Holt SHA, Brand Miller JC and Petocz P: Interrelationships among postprandial satiety, glucose and insulin responses and changes in subsequent food intake. *Eur J Clin Nut* 1996; 50: 788-797.
12. Stubbs RJ, Mazlan N, Whybrow S: Carbohydrates, appetite and feeding behavior in humans. *Journal of Nutrition* 2001; 131: 2775s-2781s.
13. Jimenez-Cruz A, Turnbull WH, Bacardí-Gascón M and Rosales-Garay P: A high-fiber, moderate-glycemic-index, Mexican style diet improves dyslipidemia in individuals with type 2 diabetes. *Nut Res* 2004; 24: 19-27.
14. Jimenez-Cruz A, Bacardí-Gascón M, Turnbull WH, Rosales-Garay P and Severino-Lugo I: A flexible, low glycemic index Mexican style diet in overweight and obese with type 2 diabetes improves metabolic parameters during a 6-week treatment period. *Diabetes Care* 2003; 26: 1967-1970.
15. Jiménez-Cruz A, Seimandi-Mora H, Bacardí-Gascón M: Efecto de dietas con bajo índice glucémimco en hiperlipidémicos. *Nutrición Hospitalaria* 2003; 18(6): 331-335.
16. Wolever TM, Jenkins JD: The use of the glycemic index in predicting the blood glucose response to mixed meals. *Am J Clin Nutr* 1986; 167-172.
17. Holt S, Brand J, Soveny C, Hansky J: Relationship of satiety to postprandial glycaemic, insulin and cholecystokinin responses. *Appetite* 1992; 18: 129-141.
18. Buyken AE, Toeller M, Heitkamp G, Karamanos B, Rottiers R, Muggeo M and cols.: Glycemic index in the diet of European outpatients with type 1 diabetes: relations to glycated hemoglobin and serum lipids. *Am J Clin Nut* 2001; 73 (3): 574-581.