The association between dietary intake of white rice and central obesity in obese adults

Majid Kolahdouzan[(1)], Hossein Khosravi-Boroujeni[(2)], Behnaz Nikkar[(1)], Elaheh Zakizadeh[(1)], Behnaz Abedi[(1)], Negar Ghazavi[(1)], Nima Ayoobi[(1)], Maryam Vatankhah[(1)]

Original Article

Abstract

BACKGROUND: Obesity has become one of the most important and the fastest growing health and nutritional problem, not only in developed but also in developing countries. White rice consumption causes an increase in postprandial blood glucose and could be a probable reason for obesity. This study was conducted to investigate the association between intake of white rice and central obesity in an Iranian population.

METHODS: In the present cross-sectional study, a total of 212 subjects were selected based on convenience non-random sampling procedure. Expert interviewers collected socio-demographic and dietary intake data by a face to face method.

RESULTS: We failed to find any significant association between frequency of white rice consumption and body mass index or waist circumference, neither in crude model nor in adjusted models.

CONCLUSION: Although there was no significant association between white rice intake and obesity factors in our study, more studies are necessary with larger population and better design.

Keywords: White Rice, Body Mass Index, Central Obesity, Diet

Date of submission: 15 Jan 2012, ***Date of acceptance:*** 22 Mar 2012

Introduction

In recent years, obesity has become one of the most important and the fastest growing health and nutritional problem not only in developed but also in developing countries.[1] WHO anticipated that globally by 2015, around 700 million adult would be clinically obese and 2.3 billion would be overweight.[2] In Iran the prevalence of weight problems [Body mass index (BMI) > 25] was 63.9% in women and 49.7% in men.[3] Obesity as a situation with excess body fat and raise in adipose tissue mass causes several health problem and metabolic diseases.[4] Individuals with BMI > 25 are considered as overweight and people who have BMI > 30 are considered obese. But BMI does not provide any information about proportion of fat, bone and muscle mass or body fat distribution. However, recent studies have revealed that abdominal fat is more important in prediction of metabolic diseases than subcutaneous fat.[5,6] Furthermore, central obesity is more closely associated with all cancers, cardiovascular risk and metabolic disorders such as hypertension, hyperlipidemia and diabetes.[7] Some studies have reported that waist circumference measurement for central adiposity is very specific and sensitive.[8,9] Although there are some sophisticated techniques for assessment of central obesity, waist circumference measurement as an anthropometric indicator, is a simple easy to use and low cost method for evaluation of abdominal fat in epidemiological studies.[8,10]

Dietary factors are associated with overweight and obesity; therefore, dietary intervention could be a target for obesity prevention.[11,12] High consumption of fiber which is found in fruit, vegetable and grain has important role in dietary interventions.[13] Previous studies showed that high consumption of whole grain in the diet, lead to lower energy intake, decrease hunger and raise satiety.[14,15] However, most of the grains are consumed after removing the outer layers and just starch rich endosperm remains. While whole grains

1- Salamat Iranian Clinic, Isfahan, Iran
2- Isfahan Cardiovascular Research Center, Isfahan Cardiovascular Research Institute, Isfahan University of Medical Sciences, Isfahan, Iran
Correspondence to: Hossein Khosravi Boroujeni, Email: khosravi_bh@yahoo.com

consumption is associated with a reduction in developing many metabolic diseases such as diabetes,[16] cardiovascular disease,[17] stroke[18] and cancers,[19] refined grains because of their high amount of carbohydrates at least partly are responsible for current obesity problem.[15] Carbohydrate as the most important source of energy in the diet associated with postprandial blood glucose. Glycemic index (GI) shows the ability of carbohydrate foods in raising the postprandial blood glucose.[20] Consumption of low GI foods contributes to reduce body fat and control obesity.[21,22] However, there are some dissimilar results.[23,24]

White rice consumption causes an increase in postprandial blood glucose as compared with brown rice. In Iranian diet, white rice is one of the most important sources of energy and carbohydrate.[25] Previous studies in Iran investigated the association between whole grain consumption and metabolic syndrome[26] but most of the studies have done on western population which is different in genetic or life style. To the best of our knowledge there is no study on white rice consumption and central obesity in Iranian population. Hence, the study aimed to explore the association between intake of white rice and central obesity in an Iranian population.

Materials and Methods

Study Population

We conducted a cross-sectional study concerning obese or overweight Iranian adults (BMI > 25) who were visited in Salamt clinic in 2009. People with insufficient information about socio-demographic data, family history, or dietary records were excluded from this survey. A sum of 212 men and women aged 18 to 56 years were selected based on convenience non-random sampling procedure. After explanation of the study protocol for participants, each one was asked to sign the consent form.

Assessment of variables

In a face-to-face method, expert interviewers collected socio-demographic characteristics including age, education and income, medical history, smoking habits and medication use. Weight and height measurement was completed in barefoot and light clothes. Participants' height measurement was done by a fixed metal ruler to the nearest 0.1 cm and weight measurement was done by a digital scale to the nearest 0.1 kg. BMI was calculated as a measure of obesity, and waist circumference was measured as a central obesity indicator. BMI was calculated as weight (kg) divided by height square (m^2). WC was measured horizontally between the iliac crest and lowest rib margin and hip circumference was measured at the maximum protrusion. Waist to hip ratio (WHR) was calculated as WC (cm) divided by hip circumference (cm). Dietary intake of study participants was evaluated with food frequency questionnaire (FFQ).

Statistical methods

For all statistical analyses, SPSS for Windows (version 15; SPSS Inc., Chicago, IL., USA) was used. To compare means of continues variables between white rice consumption groups we applied Student's t-test and for categorical variables chi-square test was used. Linear regression was employed to discover the associations between white rice consumption and obesity factors in different models. In first model, the association was adjusted for age, sex and in the second model further adjustment was done for dietary intake.

Results

Table 1 shows the characteristic of study population separated by frequency of white rice consumption per week. There was no difference in age, sex and adiposity indicators between people who consumed white rice less than 7 times per week and those who consumed more than 7 times per week. Comparison of other dietary factors such as fruit, vegetable, dairy and pulses was not different between two groups.

Multivariate adjusted regression models for obesity indicators and frequency of white rice consumption per week are presented in table 2**.** We did not find any significant association between frequency of white rice consumption and BMI or central obesity in crude model or in adjusted models.

Table 1. Characteristic of study population separated by frequency of white rice consumption per week

	Less than 7 time per week	More than 7 time per week	P
Age (years)	38.3 ± 14.4	32.2 ± 11.2	0.001
Female (%)	66.9	59.6	0.095
Smoking (%)	9.3	8.9	0.122
Weight (kg)	78.3 ± 16.7	76.4 ± 20.3	0.477
Body mass index (kg/m^2)	30.1 ± 6.4	29.0 ± 8.3	0.353
Waist circumference (cm)	88.4 ± 14.1	85.0 ± 15.8	0.182
Waist to hip ratio	0.82 ± 0.07	0.81 ± 0.07	0.284

Table 2. Multivariate adjusted regression for obesity factors and frequency of white rice consumption per week

	Less than 7 time per week	More than 7 time per week*	P
Weight (kg)			
Crude	1.00	-0.049 (-7.042–3.328)	0.481
Model 1	1.00	-0.001 (-5.030–4.972)	0.991
Model 2	1.00	0.052 (-3.341–7.240)	0.468
Body mass index (kg/m^2)			
Crude	1.00	-0.071 (-3.131–1.004)	0.312
Model 1	1.00	0.000 (-1.970–1.967)	0.999
Model 2	1.00	0.042 (-1.464–2.732)	0.552
Waist circumference (cm)			
Crude	1.00	-0.112 (-8.564–1.637)	0.182
Model 1	1.00	-0.025 (-5.541–4.003)	0.750
Model 2	1.00	-0.017 (-5.873–4.786)	0.840
Waist to hip ratio			
Crude	1.00	-0.090 (-0.036–0.011)	0.284
Model 1	1.00	-0.018 (-0.025–0.020)	0.824
Model 2	1.00	-0.028 (-0.028–0.020)	0.745

* B (95% confidence interval)
Model 1: Adjusted for age, sex
Model 2: Adjusted for age, sex and dietary intake

Discussion

In this cross-sectional study, we failed to find any association between frequency of rice consumption and body weight, BMI or central obesity. Rice is a staple food widely used in the world, especially in the eastern countries and Iran. It is an important source of carbohydrate, protein, minerals and vitamins. Recently, most of the rice has been processed and refined. During refining process, bran and germ are removed and just starchy endosperm remains in white rice.

Whole grains because of having some biological active elements including dietary fiber, vitamin E, folate, magnesium and other elements are the main components for a healthy diet.[27] In contrast, refined-grains, due to removing of these elements, are typically rich in energy and poor in nutrient content, which are accused for increasing the risk of chronic disease and obesity.[28] Refining grains changes the value of the carbohydrates to a higher GI and GL (Glycemic load). Previous studies proposed that rapid absorption of glucose after consumption of high GI foods could lead to a sharp raise in blood glucose and insulin level, thus, glucose enters the body tissues, inhibits lipolysis and induces lipogenesis and obesity.[29-31]

In line with some of the previous studies, white rice consumption was not associated with obesity factors in the current study. A prospective study did not find any difference in weight gain as a result of consumption of whole or refined grain breakfast.[14] Another study showed that rice intake with reference to other carbohydrate sources had lower potential to increase in postprandial glucose.[32] Moreover no association was found between metabolic risk factors and refined grain consumption.[33] However, these findings conflict with studies that showed dietary pattern that include white rice may be associated with obesity[34] and intake of refined-grain foods was positively related to weight gain[15] and higher visceral adipose tissue.[35] On the other hand, another study recently revealed that rice intake was inversely associated with weight gain.[36]

This discrepancy could be explained by the different source of refined-grains. In Vietnamese, the GI of white rice was reported from 86 to 109 but a review article indicated that the mean GI for white rice was 64.[37] A probable reason for finding no association between obesity factors and white rice in the current study could be explained by the GI of Iranian rice. Previous investigations showed that there are some kinds of Iranian rice with low GI (44 ± 9 for Binam rice[38] and 52.2 ± 5.1 for Sorna pearl rice[39]). They supposed that the amylase content of Iranian rice was the reason for the low GI of this rice.[38]

Another reason for these results could be explained by some studies indicated that rice protein possesses an important function in the triglyceride metabolism, that may improve body weight and adiposity,[40] so it could reduce the negative effect of high GI rice.

In this study we should consider several limitations. First, this study with a cross-sectional

design was not appropriate to conclude about causality. A further longitudinal study is necessary for stronger conclusion. On the other hand, we used a self reported qualitative FFQ for dietary intake, so we could not estimate the energy intake and it has been reported that obese individuals would like to underreport their dietary intake.[41]

In conclusion, although there was no significant association between white rice intake and obesity factors in our study, more studies are necessary with larger population and better design.

Conflict of Interests

Authors have no conflict of interests.

References

1. Bellisari A. Evolutionary origins of obesity. Obes Rev 2008; 9(2): 165-80.
2. Haslam DW, James WP. Obesity. Lancet 2005; 366(9492): 1197-209.
3. Ayatollahi SM, Ghoreshizadeh Z. Prevalence of obesity and overweight among adults in Iran. Obes Rev 2010; 11(5): 335-7.
4. Park KA, Jeon EY. Effects of the Integrative Weight Control Program Including East Asian Traditional Medicine on the Degree of Obesity and Body Composition. Korean J Rehabil Nurs 2010; 13(1): 62-9.
5. Fox CS, Massaro JM, Hoffmann U, Pou KM, Maurovich-Horvat P, Liu CY, et al. Abdominal visceral and subcutaneous adipose tissue compartments: association with metabolic risk factors in the Framingham Heart Study. Circulation 2007; 116(1): 39-48.
6. Pou KM, Massaro JM, Hoffmann U, Lieb K, Vasan RS, O'Donnell CJ, et al. Patterns of abdominal fat distribution: the Framingham Heart Study. Diabetes Care 2009; 32(3): 481-5.
7. Zhang C, Rexrode KM, van Dam RM, Li TY, Hu FB. Abdominal obesity and the risk of all-cause, cardiovascular, and cancer mortality: sixteen years of follow-up in US women. Circulation 2008; 117(13): 1658-67.
8. Taylor RW, Jones IE, Williams SM, Goulding A. Evaluation of waist circumference, waist-to-hip ratio, and the conicity index as screening tools for high trunk fat mass, as measured by dual-energy X-ray absorptiometry, in children aged 3-19 y. Am J Clin Nutr 2000; 72(2): 490-5.
9. McCarthy HD, Ellis SM, Cole TJ. Central overweight and obesity in British youth aged 11-16 years: cross sectional surveys of waist circumference. BMJ 2003; 326(7390): 624.
10. Park J, Hilmers DC, Mendoza JA, Stuff JE, Liu Y, Nicklas TA. Prevalence of metabolic syndrome and obesity in adolescents aged 12 to 19 years: comparison between the United States and Korea. J Korean Med Sci 2010; 25(1): 75-82.
11. Benjamin SE, Cradock A, Walker EM, Slining M, Gillman MW. Obesity prevention in child care: a review of U.S. state regulations. BMC Public Health 2008; 8: 188.
12. Mushtaq MU, Gull S, Mushtaq K, Shahid U, Shad MA, Akram J. Dietary behaviors, physical activity and sedentary lifestyle associated with overweight and obesity, and their socio-demographic correlates, among Pakistani primary school children. Int J Behav Nutr Phys Act 2011; 8: 130.
13. USDA. Dietary Guidelines for Americans [Online]. 2010; Available from: URL: http://www.cnpp.usda.gov/dietaryguidelines.htm/
14. Bazzano LA, Song Y, Bubes V, Good CK, Manson JE, Liu S. Dietary intake of whole and refined grain breakfast cereals and weight gain in men. Obes Res 2005; 13(11): 1952-60.
15. Liu S, Willett WC, Manson JE, Hu FB, Rosner B, Colditz G. Relation between changes in intakes of dietary fiber and grain products and changes in weight and development of obesity among middle-aged women. Am J Clin Nutr 2003; 78(5): 920-7.
16. Kochar J, Djousse L, Gaziano JM. Breakfast cereals and risk of type 2 diabetes in the Physicians' Health Study I. Obesity (Silver Spring) 2007; 15(12): 3039-44.
17. Lutsey PL, Jacobs DR, Jr., Kori S, Mayer-Davis E, Shea S, Steffen LM, et al. Whole grain intake and its cross-sectional association with obesity, insulin resistance, inflammation, diabetes and subclinical CVD: The MESA Study. Br J Nutr 2007; 98(2): 397-405.
18. Kurth T, Moore SC, Gaziano JM, Kase CS, Stampfer MJ, Berger K, et al. Healthy lifestyle and the risk of stroke in women. Arch Intern Med 2006; 166(13): 1403-9.
19. Haas P, Machado MJ, Anton AA, Silva AS, de Francisco A. Effectiveness of whole grain consumption in the prevention of colorectal cancer: Meta-analysis of cohort studies. International Journal of Food Sciences and Nutrition 2009; 60(6): 1-13.
20. Jenkins DJ, Wolever TM, Taylor RH, Barker H, Fielden H, Baldwin JM, et al. Glycemic index of foods: a physiological basis for carbohydrate exchange. Am J Clin Nutr 1981; 34(3): 362-6.
21. Retterstol K, Hennig CB, Iversen PO. Improved plasma lipids and body weight in overweight/obese patients with type III hyperlipoproteinemia after 4 weeks on a low glycemic diet. Clin Nutr 2009; 28(2): 213-5.
22. Jimenez-Cruz A, Manuel Loustaunau-Lopez V, Bacardi-Gascon M. The use of low glycemic and high satiety index food dishes in Mexico: a low cost

approach to prevent and control obesity and diabetes. Nutr Hosp 2006; 21(3): 353-6.
23. Mendez MA, Covas MI, Marrugat J, Vila J, Schroder H. Glycemic load, glycemic index, and body mass index in Spanish adults. Am J Clin Nutr 2009; 89(1): 316-22.
24. Sichieri R, Moura AS, Genelhu V, Hu F, Willett WC. An 18-mo randomized trial of a low-glycemic-index diet and weight change in Brazilian women. Am J Clin Nutr 2007; 86(3): 707-13.
25. Kimiagar S, Ghaffarpour M, Houshiar-Rad A, Hormozdyari H, Zellipour L. Food consumption pattern in the Islamic Republic of Iran and its relation to coronary heart disease. East mediterr health J 1998; 4(3): 539-47.
26. Esmaillzadeh A, Mirmiran P, Azizi F. Whole-grain consumption and the metabolic syndrome: a favorable association in Tehranian adults. Eur J Clin Nutr 2005; 59(3): 353-62.
27. Slavin JL, Martini MC, Jacobs DR, Jr., Marquart L. Plausible mechanisms for the protectiveness of whole grains. Am J Clin Nutr 1999; 70(3 Suppl): 459S-63S.
28. Steffen LM, Jacobs DR, Stevens J, Shahar E, Carithers T, Folsom AR. Associations of whole-grain, refined-grain, and fruit and vegetable consumption with risks of all-cause mortality and incident coronary artery disease and ischemic stroke: the Atherosclerosis Risk in Communities (ARIC) Study. Am J Clin Nutr 2003; 78(3): 383-90.
29. Ludwig DS. The glycemic index: physiological mechanisms relating to obesity, diabetes, and cardiovascular disease. JAMA 2002; 287(18): 2414-23.
30. Pawlak DB, Bryson JM, Denyer GS, Brand-Miller JC. High glycemic index starch promotes hypersecretion of insulin and higher body fat in rats without affecting insulin sensitivity. J Nutr 2001; 131(1): 99-104.
31. Brand-Miller JC, Holt SH, Pawlak DB, McMillan J. Glycemic index and obesity. Am J Clin Nutr 2002; 76(1): 281S-5S.
32. Ezenwaka CE, Kalloo R. Carbohydrate-induced hypertriglyceridaemia among West Indian diabetic and non-diabetic subjects after ingestion of three local carbohydrate foods. Indian J Med Res 2005; 121(1): 23-31.
33. McKeown NM, Meigs JB, Liu S, Wilson PW, Jacques PF. Whole-grain intake is favorably associated with metabolic risk factors for type 2 diabetes and cardiovascular disease in the Framingham Offspring Study. Am J Clin Nutr 2002; 76(2): 390-8.
34. Kim J, Jo I, Joung H. A rice-based traditional dietary pattern is associated with obesity in Korean adults. J Acad Nutr Diet 2012; 112(2): 246-53.
35. McKeown NM, Troy LM, Jacques PF, Hoffmann U, O'Donnell CJ, Fox CS. Whole- and refined-grain intakes are differentially associated with abdominal visceral and subcutaneous adiposity in healthy adults: the Framingham Heart Study. Am J Clin Nutr 2010; 92(5): 1165-71.
36. Shi Z, Taylor AW, Hu G, Gill T, Wittert GA. Rice intake, weight change and risk of the metabolic syndrome development among Chinese adults: the Jiangsu Nutrition Study (JIN). Asia Pac J Clin Nutr 2012; 21(1): 35-43.
37. Atkinson FS, Foster-Powell K, Brand-Miller JC. International tables of glycemic index and glycemic load values: 2008. Diabetes Care 2008; 31(12): 2281-3.
38. Darabi A, Taleban FA, Esmaili M, Valaii N. Glycemic index of split peas, rice (Binam), kidney beans, green peas, "Lavash" bread and broad bean kernels in NIDDM subjects. Acta Med Iran 2000; 38(2): 79-83.
39. Zarrati M, Pirali M, Mirmiran P, Noori N, Nakhoda K, Najafi H, et al. Glycemic Index of Various Brands of Rice in Healthy Individuals. Int J Endocrinol Metab 2008; 6(4): 200-4.
40. Yang L, Chen JH, Lv J, Wu Q, Xu T, Zhang H, et al. Rice protein improves adiposity, body weight and reduces lipids level in rats through modification of triglyceride metabolism. Lipids Health Dis 2012; 11: 24.
41. Lichtman SW, Pisarska K, Berman ER, Pestone M, Dowling H, Offenbacher E, et al. Discrepancy between self-reported and actual caloric intake and exercise in obese subjects. N Engl J Med 1992; 327(27): 1893-8.

How to cite this article: Kolahdouzan M, Khosravi-Boroujeni H, Nikkar B, Zakizadeh E, Abedi B, Ghazavi N, et al. **The association between dietary intake of white rice and central obesity in obese adults.** ARYA Atheroscler 2013; 9(2): 140-4.