Published in final edited form as:
Asia Pac J Clin Nutr. 2008 ; 17(2): 216–222.

Diet and obesity among Chamorro and Filipino adults on Guam

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Abstract

The purpose of this study was to compare the body mass index (BMI) and dietary intakes of Chamorro (n=66) and Filipino (n=61) adults, ages 25–65 years, living in Guam. Participants were recruited via community-based sampling; however, recruitment was targeted to ensure approximately equal numbers from each ethnic group, equal numbers of men and women within each ethnic group, and proportional representation of the main geographic areas of the island. In addition, subjects were recruited and stratified based on the 2000 Guam Census Data to assure proportional distribution by age. Dietary energy density (ED) was calculated as kcal/g and compared by gender, ethnicity, and obesity status. Mean BMI for Chamorros was significantly higher than for Filipinos, and a significantly higher proportion of Chamorros (49%) were obese compared to Filipinos (20%). Chamorros reported higher ED than Filipinos (1.9 kcal/g versus 1.6 kcal/g), although the difference was significant among males only. Non-obese subjects had a lower ED than obese subjects (1.9 versus 2.3 kcal/g). Overweight and obese subjects both reported a significantly higher % energy consumed as sugar-sweetened beverages than healthy weight subjects (8% and 9% versus 3%). Differences in ED may contribute to differences in obesity rates between Chamorros and Filipinos in Guam, particularly among men, and lowering ED may be an appropriate goal for nutrition interventions.

Keywords

Guam; energy density; obesity; Chamorro; Filipino

INTRODUCTION

Rates of obesity and chronic diseases such as type 2 diabetes, hypertension, cardiovascular disease, stroke, and cancer, continue to increase in the United States and other Westernized countries. Similar patterns are evident on Guam, a U.S. Territory in the Pacific. In 2003[1], 41.9% of adults in Guam were ‘normal weight’, while the rest were overweight (36.2%) or obese (21.9%); compared to the 2004 U. S. rates where 33.7% were normal weight and the rest were overweight (34.1%) or obese (32.2%).[1] About 60% of deaths on Guam are caused by chronic diseases that are linked to poor diet and lifestyle patterns.[2]

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AUTHOR DISCLOSURES

Rachael T Leon Guerrero, Yvette C Paulino, Rachel Novotny and Suzanne P Murphy, no conflicts of interest.

The diet of early Chamorros, or natives of Guam and the Northern Marianas Islands, was predominantly plant based and included taro, yams, breadfruit, bananas, cassava, coconut, and fish.[3] However, after World War II the Chamorro diet began to shift from locally grown foods to imported rice and highly processed canned goods, such as Spam®, corned beef, and Vienna sausage. The most recent dietary assessments of adults on Guam were conducted more than 20 years ago.[4–6] Since then, population dynamics have changed. The current population of Guam is characterized by substantial ethnic variation: 42.1% Chamorro, 33.3% Filipino, 6.8% Caucasian, 6.2% Asian, 7.6% other Pacific Islanders. An updated dietary assessment reflecting at least some of this diversity was needed. Therefore, we conducted a survey of adults from the two largest ethnic populations in Guam. The objectives of this study were to: (1) compare the dietary intakes of Chamorro and Filipino adults; and (2) assess the relationship between energy density (ED) and weight status.

MATERIALS AND METHODS

We conducted a cross-sectional study of 127 men and women living in Guam, aged 25 to 65 years, who were of either of Chamorro (n=66) or Filipino (n=61) ethnicity. Subjects were volunteers who were recruited by advertising in local newspapers, radio announcements, fliers, and referrals. Recruitment was targeted to ensure approximately equal numbers from each ethnic group, equal numbers of men and women within each ethnic group, and proportional representation of the main geographic areas of the island. In order to assure proportional distribution by age, subjects were recruited and stratified based on the 2000 Guam Census Data. The current study was only interested in surveying adults on Guam between the ages of 25–65 years. Within that specific age range, the 2000 Guam Census Data reported that 37% of adults were between the ages of 25 to 34 years, 33% of adults were between the ages of 35 to 44 years, 24% of adults were between the ages of 45 to 54 years, and 6% of adults were between the ages of 55 to 64 years. Therefore, recruitment for this study followed a similar pattern; 35% of subjects in this study were between the ages of 25 to 34 years, 27% of subjects were between the ages of 35 to 44 years, 23% of subjects were between the ages of 45 to 54 years, and 15% of subjects were between the ages of 55 to 64 years. The Committee on Human Research Subjects at the University of Guam approved this study.

Research assistants collected anthropometry, demographic, dietary, and physical activity data after being trained by a registered dietitian. A stadiometer (Seca, Germany) was used to measure height and a digital scale (ProFit Lifesource, Milpitas, CA) was used to measure weight. Body mass index (BMI) was calculated as kg/m^2. Subjects were classified by BMI as normal weight (≤24.9), overweight (25.0–29.9), or obese (≥30.0).

A 24-hour dietary recall was conducted using the Modified 3-Pass Method[7]. Nutrient and food group analysis was performed using the Pacific Tracker (PacTrac) Program, 4^{th} edition.[8] PacTrac was developed at the Cancer Research Center of Hawaii to analyze typical diets in Hawaii. Eighty-five recipes were added to PacTrac to ensure that the database included foods commonly consumed by Chamorro and Filipino residents on Guam.[9] Food group servings were assigned to each food or ingredient by the PacTrac program using the USDA Food Guide Pyramid as a reference.[10]

The Goldberg cut-off[11–13] was used to identify biologically implausible energy intake values. Briefly, the Goldberg cut-off is based on the fundamental physiological concept that in weight stable people, energy intake (EI) equals basal metabolic rate (BMR) times physical activity level (PAL). Variation in both EI and energy expenditure (EE) means that absolute agreement cannot necessarily be expected, hence a formula is used to calculate the upper and lower 95% confidence limits (the Goldberg cut-off) that signifies the presence of over-reporting and under-reporting respectively.[11] Since it was not possible to measure EE via doubly labeled water for

this study, BMR was estimated via the Mifflin Equation.[14–16] The Baecke Questionnaire[17–18] was used to place subjects into low, medium, or high physical activity levels for the purpose of calculating the Goldberg cut-offs.

Energy density (ED), which is the amount of energy in a given weight of food (kcals/g), was calculated for each subject based on food intake, including nutritive beverages such as milk and juice but excluding all other beverages.[19] The total energy intake from the food consumed was divided by the total weight of the food reported. Beverages may disproportionately influence dietary energy density values[19] and were therefore excluded.

The foods that contributed the most energy to the diet, by ethnic group, were determined by summing the amount of energy provided by each food and dividing by the total intake of energy. Foods were then ranked by their percent contribution.

To evaluate the quality of the beverages in a diet, the percent of energy from sugar-sweetened beverages was calculated for each subject. Sugar-sweetened beverages included carbonated soft drinks, juice-based beverages (except 100% juice), pre-sweetened coffee and tea, flavored milk, and sports and energy drinks.

Statistical analyses were performed using Statview (Abacus Concepts, Inc. 1995, version 4.5, Berkeley, CA) statistical package and SAS (version 8.2, The SAS Institute, Cary, NC). Data were age-adjusted and summarized as mean ± standard deviation unless stated otherwise. ANOVA and chi-square models were used to test for differences between groups. Significance was set at $p < 0.05$.

RESULTS

Table 1 describes basic sociodemographic and health information of the 127 subjects who volunteered to participate in the study. The mean age of the subjects was 41.3 ± 11.6 years. Filipinos were significantly more likely to have a college degree than Chamorros. Most Filipinos (75%) were born and raised in the Philippines, whereas most Chamorros (>93%) were born and raised in Guam. Chamorros had significantly higher BMI's ($p<0.0001$) than Filipinos (30.4 versus 25.9), although significant among females only. Overall, 66% of participants were overweight and 35% were obese; however, a significantly higher proportion of Chamorros (49%) were obese compared to Filipinos (20%).

Table 2 shows the macronutrient and food group intakes of subjects by gender and ethnicity. There were no significant age differences in reported dietary intake. In both ethnic groups, men consumed significantly more energy (kcals/day) than women, and Chamorro men in particular reported high energy intakes. Both ethnic groups reported mean dietary fiber intakes well below the recommended levels of 21–25 g/d for women and 30–38 g/d for men[20]. Food group intakes were also below recommendations for milk (2–3 servings/d), fruit (2–4 servings/d), and vegetables (3–5 servings/d).[10] There were no significant age differences in reported dietary intake.

When the Goldberg cut-off was used to evaluate the degree to which subjects under- and over-reported energy intake, it was found that 26.2% and 2.5% of subjects, respectively, under- and over-reported energy intake. A total of 71.3% of subjects were considered 'acceptable' reporters. There were no significant differences in under-reporting or over-reporting by gender, ethnicity, age, education, or physical activity level.

There was a significant ethnic difference in energy density (Table 2). Chamorros in this study had diets with significantly higher ($p<0.05$) energy density than Filipinos (1.86 kcal/g versus

1.61 kcal/g), although significant among males only. Chamorro males consumed significantly more added sugar than either Chamorro females or Filipinos.

Table 3 lists the 25 foods that contributed the most energy to the diet. Since there were no significant gender differences, foods are reported by ethnic group. These foods provided 50.9% of energy for Chamorros and 47.3% of energy for Filipinos. For both ethnic groups, white rice was the number one contributor of energy intake in the subjects' diets. In fact, white rice was reported on 70.1% of all 24-hour recalls collected. For Chamorros, sweetened beverages and spaghetti with tomato meat sauce were the next biggest contributors to energy intake. For Filipinos, fried chicken and sweetened beverages followed rice as the biggest contributors to energy intake. Although bananas and mangos were listed for Filipinos, neither fruits nor vegetables were important sources of energy for either ethnic group. The Chamorros consumed significantly more sweetened beverages than the Filipinos (6.8% of energy versus 3.1% of energy). Overall, the Chamorros also consumed significantly more 'sweets', including sweetened beverages and high sugar foods, than the Filipinos (12.8% of energy versus 4.4% of energy). Both ED and % of energy from sugar-sweetened beverages were positively and significantly associated with weight status. Non-obese subjects (BMI <30.0) had diets with a significantly lower ED than obese subjects (1.85 versus 2.31 kcal/g). When analyzed by ethnicity, obese Chamorros (ED = 2.04 kcal/g) reported diets with a significantly higher ED than either non-obese Chamorros (ED = 1.67 kcals/g) or non-obese Filipinos (ED = 1.56 kcal/g). Although insignificant ($p = 0.12$), obese Filipinos (ED = 1.93 kcals/g) consumed diets with a higher ED than non-obese Filipinos. Obese and overweight subjects both reported significantly higher % energy from sugar-sweetened beverages than healthy weight subjects (8–9% vs. 3%, $p < 0.05$).

DISCUSSION

Chamorro and Filipino adults in this study differed in dietary intake and rates of overweight and obesity. Compared to the data collected almost 15 years ago,[21] mean BMIs have increased in Chamorro men (2.2 points) and Chamorro women (4.8 points). The increasingly high rates of obesity and overweight observed among the Chamorros in this study may have adverse health effects because excess weight is a risk factor for several chronic diseases.[22]

Filipinos in this study had a lower prevalence of overweight and obesity than Chamorros. Significantly more Filipino males were considered obese compared to Filipino females. However, compared to earlier results,[21] Filipino men and women may also be experiencing a gradual upward shift in their body weight. Most Filipinos in this study were 'first generation' and had not spent a lifetime being exposed to the same environment, diet, and lifestyle patterns as the Chamorros. With time, it is likely that the Filipinos on Guam will adopt a more Westernized diet and lifestyle as they continue to integrate into Guam's culture. Other ethnic groups (Japanese, Koreans, Chinese, Hispanics) experienced similar changes in health parameters with acculturation as they migrated to the U.S..[23–26] With successive generations, the prevalence of overweight, obesity, and chronic diseases may increase among the Filipinos in Guam.

In this study, BMI and body weight were not significantly associated with energy intake. This lack of association may be due to differences in underreporting by BMI category, as others have found energy intake is more likely to be under-reported by obese subjects.[27–28] However, we did find a significant association between dietary ED and obesity, perhaps because this dietary density measure more accurately reflects energy intake. Obese subjects had diets that were significantly more energy dense than non-obese subjects supporting studies that found an association between low dietary ED and low body weight.[29–31] Chamorro subjects also had diets significantly more energy dense than those of the Filipinos, which is consistent with the

significantly higher rates of obesity among the Chamorros compared to the Filipinos. Results of this study suggest that the differences in dietary ED may partially explain the disparity in obesity rates.

According to the most recent report by the World Cancer Research Fund/American Institute for Cancer Research (WCRF/AICR),[32] energy density is now considered by the panel as a probable causal factor in the development of obesity; and there is now convincing evidence that shows that obesity, or body fatness, increases the risk of certain cancers such as colorectal, breast, endometrial, kidney, pancreatic, and esophageal cancers. The WCRF/AICR expert panel also recommended a public health goal for dietary energy density of 1.25 kcals/g. At 1.74 kcals/g, subjects in the present research study, especially Chamorro males, had a dietary energy density value that was much greater than the WCRF/AICR recommendation. The fat, water, and fiber content of foods appear to be the most important determinants of dietary ED.[33–34] Adults of the U. S. with a low ED diet consumed more food by weight and included a high proportion of foods high in water and micronutrients, and low in fat.[35] Thus, to decrease ED, individuals should choose more foods such as vegetables, fruits, and whole grains rather than refined grains. Selecting low-fat or reduced-fat dairy products and leaner meats or meat alternatives can also reduce ED. Beverages were excluded from our measure of ED, but sugar-sweetened beverages were frequently consumed by the study population, and overweight and obese subjects consumed a significantly higher percent of energy from sugar-sweetened beverages than healthy weight subjects. It has been suggested that the intake of sugar-sweetened beverages may be linked to obesity and weight gain by increasing overall energy intake.[36]

Some limitations may influence the interpretation of these results. Only one day of dietary information was collected, which attenuates associations of dietary variables and weight status. In addition, generalizations are limited due to convenience sampling. However, recruitment was stratified to ensure appropriate representation by age, gender, ethnicity, and geographic location. Since our study was cross-sectional, a causal association of ED and intake of sugar-sweetened beverages with obesity should not be inferred. In spite of these limitations this study provides important data because it is the first study to assess and compare the dietary intake of the two predominant ethnic populations in Guam. Results of this study provide the basis for dietary guidance on Guam until larger nutrition studies can be conducted.

Dietary ED may partially explain differences in obesity prevalence between the Chamorros and the Filipinos. Based on dietary patterns identified and current recommendations, dietary recommendations to reduce obesity in both ethnic groups should focus on lowering dietary ED by increasing intakes of vegetables, fruits, and dietary fiber, and decreasing intakes of fatty processed meats and sugar-sweetened beverages. Nutrition and health professionals in Guam have an important role in providing nutrition guidance based on current dietary guidelines, with sensitivity to local food patterns and culture.[37]

Acknowledgments

This study was funded by a U.S. National Cancer Institute Minority Institute/Cancer Research Center Partnership Grant #1056-CA-096278-01A1. We thank all staff and participants in this project, without whose help the data could not have been collected.

References

1. US Center for Disease Control, National Center for Health Statistics. Prevalence of Overweight and Obesity Among Adults: United States, 2003–2004. Hyattsville; MD: 2006.
2. Guam Department of Public Health and Social Services: Office of Vital Statistics. The Ten (10) Leading Causes of Death. Guam; 2003.

3. Pollock NJ. Food habits in Guam over 500 years. Pacific Viewpoint 1986;27:120–143.
4. Hankin J, Reed D, Labarthe D, Nichaman M, Stallones R. Dietary and Disease Patterns among Micronesians. Am J Clin Nutr 1970;23:346–357. [PubMed: 5436641]
5. Kretsch MJ, Todd KS. Nutrient intake of Guamanian women. Federation Proceedings 1985;44:756.
6. Todd KS, Kretsch MJ. Food intake patterns of Guamanian women. Federation Proceedings 1985;44:756.
7. Guenther PM, DeMio TJ, Ingwersen LA, Berline M. The multiple-pass approach for the 24-hour recall in the Continuing Survey of Food Intakes by Individuals (CFSII) 1994–96. Am J Clin Nutr 1997;65:1315s.
8. Murphy S, Blitz C, Novotny R. Pacific Tracker (PacTrac): an interactive dietary assessment program at the CRCH website. Hawaii Med J 2006;65(6):175–178. [PubMed: 16895271]
9. Martin CL, Murphy SP, Leon Guerrero RT, Davison N, Jung YO, Novotny R. The Pacific Tracker (PacTrac): Development of a dietary assessment instrument for the Pacific. J Food Composition & Analysis 2008;21:s103–s108.
10. US Department of Agriculture. The Food Guide Pyramid. Washington, DC: USDA; 1992.
11. Goldberg GR, Black AE, Jeb SA, Cole TJ, Murgatroyd PR, Coward WA, Prentice AM. Critical evaluation of energy intake data using fundamental principles of energy physiology: Derivation of cut-off limits to identify energy under-reporting. Eur J Clin Nutr 1991;45:569–581. [PubMed: 1810719]
12. Black AE. Critical evaluation of energy intake using the Goldberg cut-off for energy intake: basal metabolic rate. A practical guide to its calculations, use and limitations. Int J Obes Relat Metab Disord 2000;24:1119–1130. [PubMed: 11033980]
13. Black AE. The sensitivity and specificity of the Goldberg cutoff for EI:BMR for identifying diet reports of poor validity. Eur J Clin Nutr 2000;54:395–404. [PubMed: 10822286]
14. Mifflin MD, St Jeor ST, Hill LA, Scott BJ, Daugherty SA, Koh YO. A new predictive equation for resting energy expenditure in healthy individuals. Am J Clin Nutr 1990;51:241–247. [PubMed: 2305711]
15. Frankenfield DC, Rowe WA, Smith S, Cooney RN. Validation of several established equations for resting metabolic rate in obese and nonobese people. J Am Diet Assoc 2003;103:1152–1159. [PubMed: 12963943]
16. Frankenfield DC, Roth-Yousey L, Compher C. Comparison of predictive equations for resting metabolic rate in healthy non-obese and obese adults: a systematic review. J Am Diet Assoc 2005;105:775–789. [PubMed: 15883556]
17. Pols MA, Peters PHM, Buenode-Mesquita HB, Ocke MC, Wentink CA, Kemper HCG, Collette HJA. Validity and repeatability of a modified Baecke questionnaire on physical activity. Int J Epidemiol 1995;24:381–387. [PubMed: 7635600]
18. Beacke JAH, Burema J, Frijiers JER. A short questionnaire for the measurement of habitual physical activity in epidemiological studies. Am J Clin Nutr 1982;36:936–942. [PubMed: 7137077]
19. Ledikwe JH, Blanck HM, Kettel-Khan L, Serdula MS, Seymour JD, Tohill BC, Rolls BJ. Dietary energy density determined by eight calculation methods in a nationally representative United States Population. J Nutr 2005;135:273–8. [PubMed: 15671225]
20. Institute of Medicine, Food and Nutrition Board. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein and Amino Acids. Washington, DC: National Academy Press; 2002.
21. Pinhey TK, Heathcote GM, Rarick J. The influence of obesity on the self-reported health status of Chamorros and other residents of Guam. Asian American and Pacific Islander. J Health 1994;2:195–207.
22. Must A, Spadano J, Coadley EH, Field AE, Colditz G, Dietz WH. The disease burden associated with overweight and obesity. JAMA 1999;282:1523–1529. [PubMed: 10546691]
23. Egusa G, Watanabe H, Ohshita K, Fujikawa R, Yamane K, Okubo M, Kohno N. Influence of the extent of westernization of lifestyle on the progression of preclinical atherosclerosis in Japanese subjects. J Atheroscler Thromb 2002;9:299–304. [PubMed: 12560591]

24. Hubert H, Snider J, Winkleby M. Health status, health behavior, and acculturation factors associated with overweight and obesity in Latinos from a community and agricultural labor camp survey. Preventive Med 2005;40:642–651.
25. Steffen P, Smith T, Larson M, Butler L. Acculturation to western society as a risk factor for high blood pressure: A meta-analytic review. Psychosomatic Med 2006;68:386–397.
26. Park SY, Murphy SP, Sharma S, Kolonel LN. Dietary intakes and health-related behaviors of Korean American women born in the USA and Korea: The Multiethnic Cohort Study. Public Health Nutr 2005;8:904–911. [PubMed: 16277807]
27. Lightman SW, Pisarska K, Berman ER, Pestone M, Dowling H, Offenbacher E, Weisel H, Heshka S, Matthews DE, Heymsfield SB. Discrepancy between self-reported and actual caloric intake and exercise in obese subjects. N Engl J Med 1992;327:1893–1898. [PubMed: 1454084]
28. Kretsch MJ, Fong AK, Green MW. Behavioral and body size correlates of energy intake underreporting by obese and normal-weight women. J Am Diet Assoc 1999;99:300–306. [PubMed: 10076581]
29. Ledikwe JH, Blanck HM, Khan LK, Serdula MK, Seymour JD, Tohill BC, Rolls BJ. Dietary energy density is associated with energy intake and weight stats in US adults. Am J Clin Nutr 2006;83:1362–1368. [PubMed: 16762948]
30. Kant AK, Graubard BI. Energy density of diets reported by American adults: association with food group intake nutrient intake and body weight. Int J Obes 2005;29:950–956.
31. Cox DN, Mela DJ. Determination of energy density of freely selected diets: methodological issues and implications. Int J Obes Relat Metab Disord 2000;24:49–54. [PubMed: 10702750]
32. World Cancer Research Fund/American Institute For Cancer Research. Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective. Washington DC: AICR; 2007.
33. Yao M, Roberts SB. Dietary energy density and weight regulation. Nutr Rev 2001;59:247–258. [PubMed: 11518179]
34. Rolls BJ, Bell EA, Thorwart ML. Water incorporated into a food but not served with a food decreases energy intake in lean women. Am J Clin Nutr 1999;69:863–71. [PubMed: 10232624]
35. Ledikwe JH, Blanck HM, Kettel-Khan L, Serdula MS, Seymour JD, Tohill BC, Rolls BJ. Low-energy-density diets are associated with high diet quality in adults in the United States. J Am Diet Assoc 2006;106:1172–1180. [PubMed: 16863711]
36. Malik VS, Schulze MB, Hu FB. Intake of sugar-sweetened beverages and weight gain: a systematic review. Am J Clin Nutr 2006;84:274–288. [PubMed: 16895873]
37. US Department of Agriculture. MyPyramid. Washington, DC: USDA; 2005.

Table 1

Sociodemographic and health information[†] of subjects

	Chamorros		Filipinos	
	Females (n=34)	**Males (n=32)**	**Females (n=33)**	**Males (n=28)**
AGE				
25–34 years	29.4% (10)	37.5% (12)	36.4% (12)	35.7% (10)
35–44 years	26.5% (9)	25.0% (8)	27.3% (9)	32.1% (9)
45–54 years	26.5% (9)	21.9% (7)	21.2% (7)	21.4% (6)
55–65 years	17.6% (6)	15.6% (5)	15.1% (5)	10.7% (3)
HIGHEST EDUCATION				
Some high school	0% (0)	6.3% (2)	3.0% (1)	0% (0)
High school graduate	32.3% (11)	18.7% (6)	12.1% (4)	14.3% (4)
Some college	55.9% (19)	50.0% (16)	39.4% (13)	60.7% (17)
College graduate	11.8% (4)	25.0%(8)	45.5% (15)	25.0% (7)
PLACE OF BIRTH				
Guam	94.0% (32)	93.8% (30)	21.3% (7)	21.4% (6)
Philippines	0% (0)	0% (0)	75.7% (25)	71.4% (20)
U.S. Mainland	3.0% (1)	3.1% (1)	0% (0)	3.6% (1)
Other	3.0% (1)	3.1% (1)	3.0% (1)	3.6% (1)
HEIGHT (cm)	156.3 ± 6.3	170.5 ± 6.0[¶,§]	155.3 ± 5.9	165.9 ± 6.1[¶]
WEIGHT (kg)	74.7 ± 19.2[§]	87.5 ± 18.4[¶,§]	59.0 ± 10.4	75.9 ± 10.9[¶]
BODY MASS INDEX[‡]	30.6 ± 7.9[§]	30.0 ± 6.2	24.4 ± 3.6	27.6 ± 3.4[¶]
WEIGHT STATUS[£]				
Normal Wt (BMI<25.0)	20.6% (7)	21.9% (7)	60.6% (20)	32.1% (9)
Overweight (BMI 25.0–29.9)	38.2% (13)	21.9% (7)	30.3% (10)	35.8% (10)
Obese (BMI ≥ 30.0)	41.2% (14)	56.2% (18)	9.1% (3)	32.1% (9)

[†] Frequency % (number);

[‡] Mean ± S.D.;

[§] Significantly ($p < 0.0001$) different from Filipinos of same gender;

[¶] Significantly ($p < 0.05$) different from Females within same ethnic group;

[£] According to χ^2 analysis, distribution into categories of weight status among Chamorros significantly ($p < 0.05$) different from Filipinos

Table 2

Dietary intakes[†] by gender of the Chamorro and Filipino adults surveyed on Guam

	Chamorros		Filipinos	
	Females (n=34)	**Males (n=27)**	**Females (n=33)**	**Males (n=28)**
Total Energy (kcals/d)	1618 ± 655[‡]	2679 ± 1384	1693 ± 846[‡]	2202 ± 889
Energy Density[§] (kcals/gram)	1.7 ± 06	2.0 ± 0.8[¶]	1.6 ± 0.7	1.6 ± 0.6
Food Weight[§] (g)	876 ± 526[‡]	1398 ± 888	1211 ± 908	1198 ± 631
Beverage Weight (g)	2212 ± 1701[¶]	2476 ± 1302	1446 ± 638[‡]	2156 ± 1220
% Energy from Carbohydrate	51.1 ± 13.1	49.5 ± 9.9	47.3 ± 10.1	47.7 ± 15.3
% Energy from Fat	34.1 ± 10.7	32.4 ± 10.7	32.6 ± 8.3	29.5 ± 10.6
% Energy from Saturated Fat	10.4 ± 3.8	10.1 ± 4.3	9.8 ± 3.8	8.7 ± 3.5
% Energy from Protein	15.1 ± 4.5[¶]	16.8 ± 3.3	21.0 ± 8.5	20.6 ± 9.8
% Energy from Sugar-sweetened Beverages	7.0 ± 10.2	9.0 ± 10.0	6.2 ± 9.1	4.5 ± 8.1
Dietary Fiber (g/d)	12.7 ± 11.5	14.6 ± 8.7	13.0 ± 7.6	13.3 ± 8.6
Discretionary Fat (g/d)	42.3 ± 23.4[‡]	76.0 ± 49.3	42.0 ± 29.5	50.6 ± 47.7
Added Sugar (g/d)	59.1 ± 69.3[‡]	134.6 ± 118.3[¶]	48.9 ±48.3	53.2 ± 57.4
Vegetables (servings/d)	2.9 ± 6.9[‡]	3.2 ± 2.9	2.6 ± 3.2	2.1 ± 1.6
Fruits (servings/d)	1.1 ± 1.5	1.1 ± 2.0	2.2 ± 3.0	1.0 ± 1.8
Milk/milk alternative[ϕ] (servings/d)	0.5 ± 0.7	0.7 ± 0.6	0.5 ± 0.7	0.5 ± 0.7
Grain products (servings/d)	4.7 ± 2.6[‡]	9.4 ± 4.8	5.6 ± 3.1[‡]	7.8 ± 4.2
Whole grains (servings/d)	0.4 ± 0.8	0.2 ± 0.4	0.6 ± 1.1	0.4 ± 0.9
Meat/alternatives[ρ] (servings/d)	1.4 ± 0.8[‡]	3.1 ±1.9	2.6 ± 3.9	2.9 ± 2.2

[†] Mean ± S.D.;

[‡] Significantly ($p < 0.05$) different from Males within same ethnic group;

[§] Based on food only; all beverages excluded;

[¶] Significantly ($p < 0.05$) different from Filipinos within same gender group;

[£] "Discretionary Fat" is defined as all excess fat beyond amounts that would be consumed if only the lowest fat forms were eaten, and fats added to foods in preparation or at the table. It includes the fat from cream, butter, margarine, cream cheese, oils, salad dressings, chocolate, whole milk, sour cream, ice cream, mayonnaise, coffee whitener, and baked goods[10].;

[ϕ] "Milk/milk alternative" includes whole, low-fat, and non-fat milks, yogurts and cheeses[10].;

[ρ] "Meat/alternatives" includes meat, poultry, fish, processed meats such as frankfurters, sausage, luncheon meats, and Spam, eggs, nuts, seeds, and soybean products such as tofu and meat analogs[10].

Table 3

Top 25 foods sources of energy intake by ethnic group[†]

Rank	Chamorros	Filipinos
1	White rice, unenriched (10.63%)	White rice, unenriched (14.25%)
2	Sweetened beverages (6.83%)	Fried chicken (3.55%)
3	Spaghetti w/tomato meat sauce (3.04%)	Sweetened beverages (3.07%)
4	French fries (2.74%)	Squid (2.65%)
5	Beer (2.64%)	Portuguese sausage (2.15%)
6	Chorizo (Spanish) sausage (2.63%)	Roasted chicken (2.18%)
7	Tacos, fast food (2.54%)	White bread (1.99%)
8	Red rice (1.89%)	Whole wheat bread (1.34%)
9	Kadun Manok (chicken stew) (1.70%)	Saimin-type noodle soup (1.33%)
10	Orange Juice (1.61%)	Bananas (1.28%)
11	McDonalds crispy chicken sandwich (1.59%)	Pancit bihon (stir-fried rice noodles, vegetables, & pork) (1.187%)
12	Fried rice (1.53%)	Beef (1.17%)
13	Chicken adobo (chicken stew w/vinegar & soy sauce base) (1.49%)	Spaghetti w/tomato meat sauce (1.15%)
14	Hot dogs (1.38%)	Fish Stew (1.03%)
15	White bread (1.06%)	French fries (0.99%)
16	Pork spareribs (0.95%)	Pizza (0.93%)
17	Sweetened Cereals (0.93%)	Roasted pig (0.87%)
18	Beef Pot Roast (0.89%)	Sherbet (0.86%)
19	Chopsteak (0.78%)	Beef short-ribs (0.85%)
20	Sweet flour tortillas (0.73%)	Pork spareribs (0.79%)
21	Scrambled eggs (0.70%)	Beer (0.78%)
22	Ice cream (0.67%)	Corned beef hash, canned (0.74%)
23	Granulated sugar (0.66%)	Mango (0.73%)
24	Milk, 2% fat (0.66%)	Mayonnaise (0.71%)
25	Doughnuts (0.61%)	Alcohol, hard liquor (0.67%)

[†]Food item (% total energy)