Comparison of the dietary intake and clinical characteristics of obese and normal weight adults

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Abstract

Obesity contributes to an increased risk for chronic diseases, including diabetes, cardiovascular diseases, and certain types of cancer. The prevalence of obesity has increased in Korea. We compared the clinical and dietary characteristics of obese adults (n = 30, 17 men and 13 women, mean age 29.9) to those with a normal weight (n = 15, 8 men and 7 women, mean age 26.5). We determined lipid profiles, fasting blood sugar (FBS), blood pressure, and serum free fatty acid (FFA). Dietary intake was estimated using a food frequency questionnaire (FFQ) and a 3-day dietary record. Exercise patterns and average alcohol intake were determined. The average body mass index was 28.3 kg/m² in the obese and 21.2 kg/m² in the normal weight groups. The obese group had significantly higher levels of total cholesterol, LDL cholesterol, and triglycerides, lower levels of HDL cholesterol, and higher blood pressures compared to the normal weight group. FBS was not significantly different between the two groups. The obese (P = 0.087). No significant difference in caloric intake was observed between the two groups. No differences in carbohydrate, protein, or fat intake between two groups were observed from the FFQ. However, results from the 3-day dietary record showed that the percentage of energy from fat was significantly higher in the obese group. These results confirm that excessive weight is associated with disturbances in lipid metabolism in these fairly young and otherwise healthy adults. Dietary factors, including higher fat intake and alcohol consumption, seem to be contributing to the obesity of these subjects.

Key Words: Obesity, lipid profile, metabolic syndrome, dietary intake

Introduction

The prevalence of obesity has increased in Korea, with more than one third of the adult population currently obese [1]. Obesity is a major risk factor for many diseases, including cardiovascular diseases, diabetes, and certain types of cancer, resulting in an increased risk of death [2].

Obesity is a condition of excessive accumulation of fat due to an imbalance between energy intake and expenditure. Efforts have been made to identify dietary patterns, nutrient intake and composition, and other behavioral factors associated with obesity. Wang and Beydoun [3] reported that meat consumption was associated with risk for obesity among US adults, based on data from a 1999-2004 National Health and Nutrition Examination Survey. Higher proportions of energy consumed from protein and animal protein were shown to be associated with the risk for obesity in 2,470 women from the southwestern United States [4]. Self-reported snacking was identified as a major factor in the development of obesity in a Spanish cohort study, which followed up for 4.6 years [5]. Snack consumption and energy intake from snacks were higher in obese adolescent girls in Korea [6]. Certain eating patterns, such as skipping breakfast and lunch, eating at night, and larger self-reported portion sizes of main meals have been related to obesity [7]. While Howarth *et al.* [8] reported that eating frequency was positively associated with energy intake, and eating more than three times a day was associated with obesity, Mills *et al.* [9] showed that eating frequency was not associated with obesity. It appears that key dietary factors that contribute to the development of obesity are diverse and depend on the characteristics of the study population.

The prevalence of obesity increases with age. According to the Korean National Health and Nutrition Examination Survey

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(KNHANES) conducted in 2007, the highest prevalence of obesity in men was observed in those in their 40s (41.1%) and in women in their 60s (43.8%) [10]. Obesity increases the risk of developing metabolic diseases. The prevalence of metabolic diseases, such as hypertension, diabetes, and hypercholesterolemia, increased significantly in people over 50. On the other hand, the prevalence of elevated triglyceride levels was highest in men in their 40s and women in their 60s, which coincides with the prevalence of obesity. In the general Korean population, incidences of metabolic disease and metabolic syndrome are not high in young adults. However, young adults who are obese have an increased risk for metabolic diseases as they age.

In this study, we investigated the clinical and biochemical parameters of obese young adults to determine the metabolic abnormalities associated with the obesity. In addition, dietary intake, exercise patterns, and alcohol consumption were determined to identify factors that may contribute to obesity in young adults.

Subjects and Methods

Subjects

Thirty subjects older than 19 and younger than 60 years of age with body mass index (BMI) over 25 kg/m² (obese group) and 15 subjects with BMI between 18.5 and 23 kg/m² (normal weight group) were included in the study. None of the 45 subjects had evidence of any chronic illness, including endocrine, hepatic, renal, thyroid, or cardiac dysfunction. None of the subjects were taking medications known to affect serum lipid levels or nonsteroidal anti-inflammatory drugs, such as aspirin. Subjects who were taking dietary supplements were excluded from the study. The protocol was approved by the Seoul National University Institutional Review Board (SNUIRB) and written informed consent was obtained from all subjects.

Assessment of dietary intakes

Dietary intake was evaluated using a food frequency questionnaire (FFQ) and 3-day dietary records. The FFQ used was developed by Ahn *et al.* [11] with data from the Korea Health and Nutrition Examination Survey (KHANES) conducted in 1998 and included 103 food items. The validation and reproducibility of this FFQ has been evaluated for Korean adults [12]. Dietary records from 3 days (2 weekdays and 1 weekend) were recorded by the subjects, then the intake and amount of foods consumed was confirmed with an interview using pictures of the foods in actual size. An analysis of nutrient intake from the dietary records was performed using CAN-Pro 3.0, a nutritional analysis program developed by the Korean Nutrition Society.

Anthropometric measurement

Body weight and waist and hip circumferences were measured using InBody 520 (Biospace, Korea). Standing height without shoes was measured using a stadiometer.

Blood samples

Blood was collected in blood collection tubes after a 12-hour overnight fast. Blood for serum biochemical analysis was collected in serum separator tubes (BD vacutainer® SST, Becton Dickinson, United Kingdom). Blood for complete blood cell (CBC) analysis was collected in EDTA tubes (Standard Plus & Medical Co.,Ltd., Korea).

Biochemical analysis

Blood glucose, total cholesterol, HDL-cholesterol, and triglycerides were measured using Cobas Integra® 400 plus (Roche, Switzerland). LDL-cholesterol was measured by elimination and an enzymatic assay in Green Cross Reference Lab (Korea).

Measurement of serum free fatty acids

Nonesterified fatty acid levels in serum were measured using SICDIA NEFAZYME (Shinyang Chemical Co.,Ltd., Korea).

Blood pressure measurement

Blood pressure was measured after 10 or more minutes of rest using an automatic blood pressure monitor (Jawon Medical, Korea).

Statistical analysis

Data were analyzed using the SYSTAT statistical package (SYSTAT 10.0, 2000; SYSTAT, Inc., Evanston, IL). An ANOVA for overall effect of group and sex was carried out for dietary intake outcomes followed by Fisher's Least-Significant-Difference test for individual group comparisons. Pearson correlations were used to determine associations between dietary intakes assessed by 3-day dietary records and FFQs. A student's *t*-test was used to test for differences in clinical parameters between obese and normal weight groups. A Kruskal-Wallis nonparametric test was used for parameters that were not normally distributed. A Chi-square test was used to test for differences in the prevalence of dyslipidemia and metabolic syndrome. Data are reported as means \pm SEM. Significance was set at P < 0.05.

Results

Demographic and anthropometric characteristics of subjects

The demographic and anthropometric characteristics of test subjects are shown in Table 1. The mean age of the obese group was 29.9 ± 1.7 years and that of the normal weight group was 26.5 ± 1.3 years. There was no significant age difference between the two groups. The average heights of the obese and normal weight groups were similar for both men $(173.3 \pm 0.9 \text{ cm} \text{ and } 173.4 \pm 2.4 \text{ cm}$, respectively) and women $(161.6 \pm 1.1 \text{ cm} \text{ and } 159.0 \pm 1.4 \text{ cm}$, respectively). Weight and BMI were significantly

Table	1.	Demographic	and	anthropometric	characteristics	of	subjects.
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	Normal weight	Obese	 Significance	
Number of subjects	N = 15 (8 Men, 7 Women)	N = 30 (17 Men, 13 Women)		
Age (yrs)	26.5 ± 1.3	29.9 ± 1.7	N.S.	
Men	25.3 ± 1.0	31.2 ± 2.4	N.S.	
Women	28.0 ± 2.4	28.2 ± 2.4	N.S.	
Height (cm)				
Men	173.4 ± 2.4	173.3 ± 0.9	N.S.	
Women	159.0 ± 1.4	161.6 ± 1.1	N.S.	
Weight (kg)				
Men	64.9 ± 2.4	85.6 ± 1.9	<i>P</i> < 0.001	
Women	52.8 ± 1.5	73.6 ± 3.1	<i>P</i> < 0.001	
BMI (kg/m ²)	21.2 ± 0.3	28.3 ± 0.5	<i>P</i> < 0.001	
Men	21.5 ± 0.4	28.5 ± 0.5	<i>P</i> < 0.001	
Women	20.9 ± 0.5	28.2 ± 1.0	<i>P</i> < 0.001	
Waist Circumference (cm)				
Men	75.3 ± 1.8	93.7 ± 1.2	<i>P</i> < 0.001	
Women	73.0 ± 3.8	90.9 ± 3.2	<i>P</i> = 0.003	
Hip Circumference (cm)				
Men	89.8 ± 1.7	102.7 ± 1.1	<i>P</i> < 0.001	
Women	92.3 ± 6.5	104.6 ± 2.9	<i>P</i> = 0.062	
WHR				
Men	0.838 ± 0.007	0.912 ± 0.006	<i>P</i> < 0.001	
Women	0.796 ± 0.018	0.868 ± 0.011	<i>P</i> = 0.002	

BMI, Body Mass Index: WHR, Waist-hip ratio

Values are means \pm SEM.

Significance was tested by the Student's t-test.

Table 2. Clinical characteristics of subjects.

Number of subjects	Normal weight (n = 15)	Obese (n = 30)	Significance
Total cholesterol (mg/dL)	159.9 ± 7.8	189.8 ± 4.7	<i>P</i> = 0.003
LDL-Cholesterol (mg/dL)	86.3 ± 8.6	117.0 ± 4.7	<i>P</i> = 0.005
HDL-Cholesterol (mg/dL)	61.9 ± 2.7	51.6 ± 2.1	<i>P</i> = 0.005
Triglyceride (mg/dL)	87.4 ± 8.9	130.1 ± 12.2	<i>P</i> = 0.007
Glucose (mg/dL)	92.0 ± 2.1	92.9 ± 1.8	N.S.
Blood pressure (mmHg)			
Systolic	121.9 ± 2.9	131.1 ± 2.8	<i>P</i> = 0.030
Diastolic	71.4 ± 2.5	78.9 ± 2.3	P=0.036

Values are means \pm SEM.

Significance was tested by the Student's #test

LDL, Low-density lipoprotein: HDL, High-density lipoprotein

different between the obese and normal weight groups as we recruited subjects based on BMI (Table 1). Waist circumferences were significantly higher (P < 0.001) in the obese group. Within the obese group, the average waist circumferences of both men and women were large enough for them to be classified as obese based on waist circumference alone.

Clinical characteristics of subjects

Fasting blood glucose levels, blood pressure measurements, and serum lipid profiles, including total cholesterol, LDL-cholesterol, HDL-cholesterol, and triglycerides, are presented in Table 2. The obese group had significantly higher levels of total cholesterol (P = 0.003, 30.0 mg/dL higher), LDL-cholesterol (P = 0.005, 30.7 mg/dL higher), and triglycerides (P = 0.007, 42.7 mg/dL higher) and significantly lower levels of HDL-cholesterol (P = 0.005, 10.3 mg/dL lower) as compared to the normal weight group. Systolic (P = 0.030) and diastolic blood pressures (P = 0.036) were also significantly higher in the obese group. There was no significant difference in blood glucose levels between

Table 3. Number of subjects with metabolic syndrome and abnormal lipid profiles and blood pressure.

Criteria	Normal weight (n = 15)	Obese (n = 30)	Significance	
	N (%)	N (%)		
Total cholesterol			<i>P</i> = 0.008	
High: > 230 mg/dL	1 (6.7)	0 (0.0)		
Borderline: 200-229 mg/dL	0 (0.0)	12 (40.0)		
Normal: < 200 mg/dL	14 (93.3)	18 (60.0)		
LDL-Cholesterol			P=0.327	
High: >150 mg/dL	1 (6.7)	3 (10.0)		
Borderline: 130-149 mg/dL	1 (6.7)	7 (23.3)		
Normal: < 130 mg/dL	13 (86.7)	20 (66.7)		
HDL-Cholesterol			P=0.076	
Low: <40 mg/dL for men or <50 mg/dL for women	1 (6.7)	9 (30.0)		
Normal: >40 (men) or 50 (women) mg/dL	14 (93.3)	21 (70.0)		
Triglyceride			P=0.538	
High: > 200 mg/dL	0 (0.0)	2 (6.7)		
Borderline: 150-199 mg/dL	1 (6.7)	3 (10.0)		
Normal: < 150 mg/dL	14 (93.3)	25 (83.3)		
Systolic blood pressure			<i>P</i> = 0.071	
Hypertensive:> 140 mmHg	0 (0.0)	8 (27.6)		
Prehypertensive: 120-139 mmHg	7 (50.0)	8 (27.6)		
Normal: < 120 mmHg	7 (50.0)	13 (44.8)		
Diastolic blood pressure			P=0.178	
Hypertensive: > 90 mmHg	1 (7.1)	3 (10.3)		
Prehypertensive: 80-89 mmHg	1 (7.1)	9 (48.6)		
Normal: < 80 mmHg	12 (85.7)	17 (31.0)		
Metabolic syndrome			<i>P</i> = 0.027	
With	0 (0.0)	8 (26.7)		
without	15 (100.0)	22 (73.3)		

Significance was tested by a Chi-square test,

LDL, Low-density lipoprotein: HDL, High-density lipoprotein

Table 4. Nutrient intake of subjects assessed with a FFQ and 3-day dietary record

Normal weight (n = 15, Obese (n = 30, men = 1, worman = 1) Normal weight (n = 15, Obese (n = 30, men = 1) Constance of the power and the powe	Nutrient	FFQ		3-day diet	Correlation between FFQ and Dietary record		
Emergy (cab) 2.572 + 22.50 2.775 + 12.07 1.9867 + 102.3 2.143.5 + 1369 r = 0.42 P = 0.00 Wormen 2.160 5 + 22.41 2.043.3 + 252.4 1.832.4 + 107.8 1.903 7 + 105.7 P = 0.01 Mormen 0.054 + 10.4 1.94.7 + 12.9 641.47.8 1.903 7 + 105.7 P = 0.01 Mormen 0.064 + 14.0 1.14.7 + 12.9 641.47.8 1.02.2 + 10.3 P = 0.01 Wormen 0.064 + 14.0 1.14.7 + 12.9 641.47.8 1.02.2 + 10.3 P = 0.01 Wormen 0.064 + 65.9 662.2 + 63 60.5 + 4.2 65.2 + 63 7.05 + 10.4 P = 0.02 Wormen 71.2 + 7.6 7.0 = 2.98 640.42 + 8.8 65.9 + 10.4 P = 0.02 Wormen 3.01 + 5.0 647.2 + 7.3 55.5 + 4.5 7.05 + 10.8 P = 0.02 Merin 4.23.1 + 10.5 2.23.1 + 10.7 + 12.7 2.75 + 12.6 P = 0.02 Merin 3.01 + 5.7 2.25.4 + 10.7 + 13.3 3.71 + 15.7 P = 0.02 Morin 3.03 + 5.4 3.04 + 2.4 1.05 + 14.1 2.75 + 12.6		Normal weight (n = 15, men = 8, women = 7)	Obese (n = 30, men = 17, women = 13)	Normal weight (n = 15, men = 8, women = 7)	Obese (n = 30, men = 17, women = 13)	Correlation coefficient	P-value
Mem 2.83.3 : 951.6 3.06.4.4 : 3.06.4.4 : 2.069.1 : 1+63.6 2.258.0 : 1+80.7 Vernern 2.166.5 : 2.24.1 0.22.4 : 107.8 : 1+07.8 : 107.4 : 140.7 : 10.08.7 : 160.7 r=0.51 P=0.010 Mem 0.06.4 : 1.0.0 : 117.7 : 12.8 : 04.1 : 7.8 : 102.5 : 10.3 : 107.4 : 16.5 : 0.6 : 15.7 : 0.1 : 10.4 : 17.8 : 102.5 : 10.3 : 107.4 : 16.3 : 00.5 : 12.8 : 10.4 : 10.4 : 10.6 : 17.4 : 0.5 : 10.6 : 17.4 : 0.6 : 17.4 : 10.4 : 10.6 : 17.4 : 0.5 : 10.6 : 17.4 : 10.4 : 10.6 : 17.4 : 0.5 : 10.6 : 17.4 : 10.4 : 10.6 : 17.4 : 0.5 : 10.6 : 10.7 : 10.5 : 10.6 : 10.7 : 10.5 : 10.6 : 10.7 : 10.5 : 10.6 : 10.7 : 10.5 : 10.6 : 10.7 : 10.5 : 10.6 : 10.7 : 10.5 : 10.6 : 10.7 : 10.5 : 10.6 : 10.7 : 10.5 : 10.6 : 10.7 : 10.5 : 10.5 : 10.6 : 10.7 : 10.5 : 10.5 : 10.5 : 10.6 : 10.7 : 10.5 : 10.5 : 10.5 : 10.5 : 10.5 : 10.6 : 10.7 : 10.5 :	Energy (kcal)	2,517.2 ± 225.9	2,775.1 ± 2,10.7	1,958.7 ± 102.3	2,143.5 ± 139.9	r = 0.452	<i>P</i> = 0.002
Women 2,169,5,224,1 2,423,3,252,4 1,802,4,210,8 1,907,7,108,7 Men 106,4,14,0 114,7,12,9 94,4,17,8 102,5,10,3 r=0,01 P=0,010 Women 66,6,10,4 98,3,49,9 74,9,4,8 84,5,8,9 r=0,01 P=0,010 Women 66,6,10,4 98,3,49,9 74,9,4,8 84,5,8,9 r=0,20 P=0,010 Men 71,2,7,6 70,8,9,8 64,9,4,8 85,9,4,10,8 r=0,20 P=0,017 Men 71,2,7,6 70,8,9,8 64,9,4,8 85,9,4,10,8 r=0,32 P=0,001 Men 32,2,7,15 22,3,2,10 27,8,1,3 33,7,1,3,7 P=0,002 Carbohydrate (g) 30,9,7,3,8,1 439,3,4,5,8 260,9,41,9 242,1,22,6 27,5,1,9,8 P=0,002 Men 30,6,4,4 36,4,4,4 160,2,1,1,7,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1,1	Men	2,830.3 ± 351.6	$3,043.4 \pm 3,08.4$	2,069.1 ± 163.6	$2,258.0 \pm 196.9$		
Protein (a) 97.2 ± 9.0 107.6 ± 6.5 79.8 ± 4.7 94.7.2 94.1 ± 7.8 002.5 ± 10.3 Women 86.6 ± 10.4 98.3 ± 9.9 74.9 ± 4.8 84.5 ± 9.9 r = 0.208 P = 0.11 Women 86.6 ± 10.4 98.3 ± 9.9 74.9 ± 4.8 84.5 ± 9.9 r = 0.208 P = 0.17 Men 71.2 ± 7.6 65.2 ± 0.6 7.4 ± 6.8 85.9 ± 10.4 r = 0.208 P = 0.17 Men 71.2 ± 7.5 0.2 2.3 ± 1.0 0.64.4 ± 2.6 ± 0.5 ± 4.5 76.9 ± 10.8 r = 0.321 P = 0.032 Men 44.21 ± 62.5 490.9 ± 51.9 22.0 ± 18.1 235.5 ± 15.3 r = 0.321 P = 0.032 Women 31.0 ± 5.7 32.5 ± 4.3 170.2 ± 1.3 37.7 ± 1.8 r = 0.404 P = 0.002 Women 31.0 ± 5.7 32.5 ± 4.3 172.2 ± 1 173.± 1.8 r = 0.404 P = 0.002 Women 31.0 ± 5.7 32.5 ± 4.3 172.2 ± 1 173.± 1.8 r = 0.404 P = 0.002 Women 31.0 ± 5.7 32.5 ± 4.3 172.2 ± 1 173.± 1.8	Women	$2,159.5 \pm 224.1$	$2,424.3 \pm 2,52.4$	1,832. 4 ± 107.8	1,993.7 ± 195.7		
Mem 106 4: 14.0 114.7: 12.9 84.1: 7.8 102.5: 10.3 Wormen 86.5: 10.6 157: 10.4 165: 40.6 176: 10.5 Fat. (g) 64.8: 5.0 682: 26.3 60.5: 4.2 82.0: 27.4* r=0.208 P=0.171 Mem 77.1: 2.0 64.7: 7.3 65.5: 4.5 76.9: 10.8 P=0.171 Wernen 67.7: 1: 20.3: 10 27.27: 81.3 33.3: 7: 1.5 22.3: 10 27.27: 81.3 33.7: 1: 15 r=0.217 Carbonydrafe (g) 300 7: 9: 1 42.3: 16: 27 35.5: 1.5 22.1: 12.2 247.5: 10.6 r=0.321 P=0.002 Wernen 33.1: 9: 37.0 368.0: 40.9 242.1: 22.6 247.5: 10.6 r=0.44 P=0.002 Wormen 30.0: 6: 4.4 36.4: 4.4 16.0: 1: 1.3 17.8: 1.2 r=0.44 P=0.002 Mem 30.0: 6: 4.4 44.0: 9: 8.0 306.7: 44.2 45.8: 4.37 r=0.061 Mem 30.0: 6: 4.4 44.0: 9: 8.0 306.7: 44.2 45.8: 4.77 r=0.061 Mem 30.0: 6: 4.4 44.0: 9: 8.0 <td>Protein (g)</td> <td>97.2 ± 9.0</td> <td>107.6 ± 8.5</td> <td>79.8 ± 4.7</td> <td>94.7 ± 7.1</td> <td>r = 0.351</td> <td><i>P</i> = 0.018</td>	Protein (g)	97.2 ± 9.0	107.6 ± 8.5	79.8 ± 4.7	94.7 ± 7.1	r = 0.351	<i>P</i> = 0.018
Women 86.6 ± 10.4 96.3 ± 9.8 74.9 ± 4.8 94.5 ± 8.8 Fat (g) 155 ± 0.6 157.0 4 165 ± 0.4 165 ± 0.4 82.0 ± 7.4" r = 0.208 P = 0.171 Men 77.1 ± 7.6 70.8 ± 9.8 64.9 ± 6.8 85.9 ± 10.4 P = 0.021 Women 57.1 ± 20 64.7 ± 7.3 55.5 ± 4.5 76.9 ± 10.8 P = 0.021 Carbohydnie (g) 30.7 ± 7.5 22.3 ± 10 27.8 ± 1.3 33.7 ± 1.8" P = 0.021 Carbohydnie (g) 30.6 ± 1.5 62.9 ± 1.2 23.5 ± 10.8 P = 0.021 Precent cackeles from carbohydnie (%) 6.6 ± 1.5 62.9 ± 1.2 23.5 ± 10.8 1 = 0.44 P = 0.002 Men 30.6 ± 5.7 32.5 ± 4.3 17.0 ± 1.3 17.8 ± 1.2 r = 0.44 P = 0.002 Men 30.6 ± 5.7 32.5 ± 4.3 17.2 ± 2.1 17.3 ± 1.8 C P = 0.021 Colesterol (mg) 366.1 ± 1.4 37.1 ± 7.0 46.9 ± 9.9.3 C C C P = 0.021 Men 30.0 ± 5.7 32.5 ± 7.8 17.2	Men	106.4 ± 14.0	114.7 ± 12.9	84.1 ± 7.8	102.5 ± 10.3		
Peccent calories from protein (%) 15.5 ± 0.6 15.7 ± 0.4 16.4 ± 0.6 17.6 ± 0.5	Women	86.6 ± 10.4	98.3 ± 9.9	74.9 ± 4.8	84.5 ± 8.9		
Fat (p) 64 6 ± 59 66 2 ± 63 60 5 4 24 82 0 + 74 r = 0.208 P = 0.17 Men 71 2 ± 7.6 70 8 ± 98 64 9 ± 68 85 9 ± 10.4 P = 0.03 Percent calories from fat (%) 23.7 ± 1.5 22.3 ± 1.0 27.8 ± 1.3 33.7 ± 87 P = 0.03 Carbolydrafe (g) 300.7 ± 30.1 43.9 ± 30.8 28.0 ± 21.4 28.5 ± 15.3 r = 0.321 P = 0.03 Men 442.1 ± 22.5 440.9 ± 12.2 23.5 ± 19.6 P = 0.044 P = 0.004 Percent calories from carbolydrate (%) 61.6 ± 1.9 62.9 ± 12. 53.5 ± 19.6 P = 0.044 P = 0.004 Men 30.8 ± 3.4 34.2 ± 31 17.0 ± 1.3 17.8 ± 1.2 r = 0.444 P = 0.001 Men 30.6 ± 5.7 32.5 ± 4.3 17.2 ± 2.1 17.3 ± 1.8 r = 0.448 P = 0.001 Men 30.6 ± 5.7 32.5 ± 4.3 17.2 ± 2.1 17.3 ± 1.8 r = 0.468 P = 0.001 Men 30.6 ± 5.4 440.1 ± 3.8 36.6 ± 4.402 43.6 ± 3.6 ± 3.6 ± 3.6 ± 3.6 ± 3.6 ± 3.6 ± 3.6 ± 3.6 ± 3.6 ± 3.6 ± 3.6 ± 3.6 ± 3.6 ± 3.6 ± 3.	Percent calories from protein (%)	15.5 ± 0.6	15.7 ± 0.4	16.4 ± 0.6	17.6 ± 0.5		
Menn 77.12 ± 7.6 70.8 ± 9.8 64.9 ± 6.8 85.9 ± 10.4 Wornen 57.1 ± 50 64.7 ± 7.3 55.5 ± 4.5 76.9 ± 10.8 78.9 ± 10.4 Parcent calories from fat (%) 23.7 ± 1.5 22.3 ± 1.0 27.8 ± 1.3 33.7 ± 1.8* Carboxydrafe (g) 390.7 ± 9.1 439.3 ± 3.8 262.9 ± 1.81 29.5 ± 1.62 74.7 ± 1.8* Wornen 33.1 ± ± 7.0 386.0 ± 4.09 242.1 ± 2.2.6 247.5 ± 1.9.6 75.1 ± 1.0 Wornen 30.6 ± 4.4 35.4 ± 4.4 16.9 ± 1.8 17.2 ± 1.1 7.3 ± 1.8 7 Wornen 310.4 ± 7.1 34.6 ± 69.3 369.7 ± 4.6.2 453.8 ± 36.7 r = 0.404 P= 0.001 Men 30.6 ± 4.4 35.4 ± 4.4 169.9 ± 1.8 11.1 7 7.9 ± 0.81 Mornen 33.0 ± 4.4 443.6 ± 69.3 361.7 ± 6.2 43.3 ± 8.3 € 7 r = 0.461 P= 0.001 Mornen 28.2 ± 12.7 436.9 ± 7.14.2 44.15 ± 4.7.7 49.9 ± 5.9.3 7.8 ± 2.11 7.1 ± 4.11 7.1 ± 4.11 7.1 ± 4.11 7.1 ± 4.11 7.1 ± 4.11	Fat (g)	64.6 ± 5.9	68.2 ± 6.3	60.5 ± 4.2	$82.0 \pm 7.4^{\#}$	r = 0.208	<i>P</i> = 0.171
Women 57.1 ± 9.0 64.7 ± 7.3 55.5 ± 4.5 77.9 ± 10.8 Percent calories from fat (%) 23.7 ± 1.5 22.3 ± 1.0 27.8 ± 1.3 33.7 ± 1.6" Carbohydneire (g) 300.7 ± 30.1 439.3 ± 36.8 262.9 ± 16.1 263.5 ± 1.5.3 r = 0.321 P = 0.032 Men 442.1 ± 62.5 439.9 ± 51.9 261.0 ± 27.4 27.57 ± 22.6 247.5 ± 10.8 P = 0.001 Women 31.9 ± 57.0 32.6 ± 4.3 17.0 ± 1.3 17.8 ± 1.2 r = 0.404 P = 0.001 Men 30.6 ± 3.4 44.2 ± 3.1 17.0 ± 1.3 17.8 ± 1.2 r = 0.404 P = 0.001 Men 30.6 ± 5.4 32.5 ± 4.3 17.2 ± 2.1 17.3 ± 1.8 T = 0.404 P = 0.001 Men 430.4 ± 47.1 437.6 ± 60.3 361.3 ± 50.1 441.5 ± 47.7 Women 282.1 ± 27.9 383.1 ± 46.1 477.1 ± 7.40 469.9 ± 50.3 Calcium (mg) 860.7 ± 123.7 942.5 ± 112.9 468.8 ± 71.2 17.8 ± 2.1 ± 1.4 T = 0.463 P = 0.002 Mon 1.607.6 ± 198.3 1.633.9 ± 170.8 1.603.3 ± 88.4	Men	71.2 ± 7.6	70.8 ± 9.8	64.9 ± 6.8	85.9 ± 10.4		
Percent calories from fat (%) 23.7 ± 1.5 22.3 ± 1.0 27.8 ± 1.3 33.7 ± 1.8" Carbohydrate (g) 300.7 ± 30.1 459.3 ± 35.8 282.9 ± 18.1 283.7 ± 1.6" P = 0.032 Wornen 33.1 9 ± 37.0 386.0 ± 40.9 242.1 ± 22.6 247.5 ± 19.6 P = 0.032 Wornen 33.0 ± 3.4 34.2 ± 3.1 17.0 ± 1.3 17.8 ± 1.2 r = 0.404 P = 0.004 Men 30.6 ± 4.4 36.4 ± 4.4 16.9 ± 1.8 11.1 ± 7. Wornen 27.6 ± 5.4 ± 3.3 17.2 ± 2.1 17.3 ± 1.8 r = 0.404 P = 0.004 Wornen 30.6 ± 4.4 34.4 ± 4.4 16.9 ± 1.8 11.5 ± 7.7 Wornen 28.5 ± 4.3 17.2 ± 2.1 17.3 ± 1.8 r = 0.001 P = 0.001 Men 439.4 ± 47.1 437.6 ± 58.3 361.3 ± 59.1 441.5 ± 4.7.7 Wornen 282.1 ± 8.0 637.2 ± 78.8 561.4 ± 4.94 469.8 ± 15.3 7 = 0.463 P = 0.001 Morn 282.1 ± 8.0 637.2 ± 78.8 561.4 ± 4.94 469.8 ± 15.3 1 = 0.468 P = 0.002 Morn 12.0 ± 71.4 ± 1.1 <t< td=""><td>Women</td><td>57.1 ± 9.0</td><td>64.7 ± 7.3</td><td>55.5 ± 4.5</td><td>76.9 ± 10.8</td><td></td><td></td></t<>	Women	57.1 ± 9.0	64.7 ± 7.3	55.5 ± 4.5	76.9 ± 10.8		
Carbolydrate (g) 390.7 ± 39.1 430.3 ± 36.8 282.9 ± 18.1 282.5 ± 15.3 r = 0.321 P = 0.032 Men 442.1 ± 62.5 443.3 ± 51.9 281.0 ± 27.4 275.7 ± 22.6 247.5 ± 18.6 Wornen 31.9 ± 37.0 366.0 ± 40.9 242.1 ± 22.6 247.5 ± 18.6 P = 0.002 Piber (g) 30.8 ± 34 35.4 ± 4.4 16.9 ± 1.8 18.1 ± 1.7 V Wenen 30.6 ± 4.4 35.4 ± 4.4 16.9 ± 1.8 18.1 ± 1.7 V P = 0.001 P = 0.001 Men 30.6 ± 4.4 437.6 ± 50.3 361.3 ± 50.1 441.5 ± 47.7 V P = 0.001 Men 359.7 ± 23.7 942.5 ± 12.2 1.73.1 ± 1.0 1.73.1 ± 1.1 V Men 20.1 ± 2.7 383.1 ± 46.1 437.1 ± 7.0 440.9 ± 50.3 P = 0.001 Men 20.2 ± 76.3 V P = 0.002 Men 1.003.1 ± 10.2 1.10.3 ± 1.1 ± 1.1 1.20.4 ± 44.1 ± 7.7 Men 1.200.4 ± 84.6 r = 0.484 P = 0.021 Men 1.207.6 ± 108.3 <td>Percent calories from fat (%)</td> <td>23.7 ± 1.5</td> <td>22.3 ± 1.0</td> <td>27.8 ± 1.3</td> <td>33.7 ± 1.8*</td> <td></td> <td></td>	Percent calories from fat (%)	23.7 ± 1.5	22.3 ± 1.0	27.8 ± 1.3	33.7 ± 1.8*		
Men 442 1 ± 625 493 9 ± 51 3 281 0 ± 27 4 275 7 ± 22 6 Women 331 9 ± 37 0 368 0 ± 40 9 242 1 ± 22 6 247 5 ± 19 6 Percent calcies from carbohydrate (%) 61 6 ± 1 9 62 9 ± 1 2 55 ± 1 9 60.1 ± 1 Fiber (g) 30 8 ± 3.4 34 2 ± 3.1 17 0 ± 1.3 17.8 ± 12 r = 0.404 P = 0.001 Men 30.6 ± 3.4 414 0 ± 38.6 396.7 ± 46.2 453.8 ± 36.7 r = 0.061 P = 0.691 Men 439.4 ± 47.1 437.6 ± 50.3 361.3 ± 61.4 441.6 ± 47.7 r = 0.463 P = 0.001 Mon 282.1 ± 27.9 383.1 ± 45.1 457.1 ± 74.0 469.9 ± 50.3 r = 0.463 P = 0.001 Men 282.1 ± 27.9 383.1 ± 45.1 473.1 ± 74.0 469.9 ± 50.3 r = 0.463 P = 0.002 Men 1.507.6 ± 193.3 1.633.3 ± 173.8 103.3 ± 174.7 17.82.7 ± 14.1 r = 0.463 P = 0.002 Mon 1.507.6 ± 193.3 1.633.3 ± 173.8 103.3 ± 64.0 1.100.8 ± 10.3 r = 0.448 P = 0.002 Mon	Carbohydrate (g)	390.7 ± 39.1	439.3 ± 35.8	262.9 ± 18.1	263.5 ± 15.3	r = 0.321	P=0.032
Women 331.9±37.0 368.0±4.0.9 242.1±22.6 247.5±18.6 Percent calorles from carbohydrate (%) 61.6±1.9 62.9±12 53.5±1.9 60.1±1.2 r=0.404 P=0.002 Men 30.6±4.4 35.4±4.4 16.9±1.8 181.8±1.7 r=0.404 P=0.002 Men 30.6±5.7 32.5±4.3 17.2±2.1 17.3±1.8 r=0.061 P=0.062 Cholesterol (mg) 366.0±3.44 414.10±3.86 396.7±4.62 453.8±3.67 r=0.061 P=0.062 Momen 282.1±2.79 383.1±4.61 437.1±7.40 466.9±7.12 r=0.463 P=0.002 Momen 856.7±12.7 942.5±112.9 496.8±7.12 718.2±114.1 r=0.468 P=0.002 Momen 1.507.6±108.3 1.633.9±179.8 1.053.2±8.4 1.276.5±127.5 r=0.448 P=0.002 Momen 1.507.6±198.3 1.633.9±179.8 1.053.2±8.4 1.276.5±127.5 r=0.448 P=0.022 Momen 1.507.6±198.3 1.633.9±179.8 1.053.2±8.4 1.276.5±127.5 r=0.428 P=0.026 P	Men	442.1 ± 62.5	493.9 ± 51.9	281.0 ± 27.4	275.7 ± 22.6		
Percent calories from carbohydrate (%) 616±19 629±12 635±19 60.1±12 Filer (g) 30.8±3.4 34.2±3.1 17.0±1.3 17.8±12 r=0.404 P=0.004 Men 30.6±4.4 35.4±4.4 16.9±1.8 18.1±1.7 Cholesterol (mg) 366.0±34.4 414.0±38.6 396.7±62.2 17.3±1.8 r=0.061 P=0.691 Men 439.4±7.1 457.6±50.3 361.3±69.1 4415.4±7.7 =0.061 P=0.691 Wormen 282.1±27.9 383.1±65.1 437.1±74.0 469.9±59.3 =0.061 P=0.061 Men 551.4±49.4 675.8±72.1 r=0.463 P=0.001 Men 150.7±123.7 983.1±83.0 137.8±63.0 120.4±8.4 r=0.448 P=0.0021 Men 1,607.6±198.3 1,563.9±1798 1,063.2±88.4 1,276.5±127.5 Men 1,281.4±159 1,33.0±14.2 1,033.6±64.0 1,200.4±8.4 r=0.327 P=0.022 Men 2,01±3.0 2,1±1±1.7 14.5±1.0 18.3±1.9 r=0.327	Women	331.9 ± 37.0	368.0 ± 40.9	242.1 ± 22.6	247.5 ± 19.6		
Fiber (g) 30.8 ± 3.4 34.2 ± 3.1 17.0 ± 1.3 17.8 ± 1.2 $r = 0.404$ $P = 0.006$ Men 30.6 ± 4.4 354 ± 4.4 16.9 ± 1.8 15.1 ± 1.7 $P = 0.001$ Women 31.0 ± 5.7 32.5 ± 4.3 17.2 ± 2.1 17.3 ± 1.8 $P = 0.691$ Men $439.4 \pm 4.7.1$ 437.6 ± 50.3 361.3 ± 50.1 441.5 ± 47.7 $P = 0.691$ Women 282.1 ± 27.9 383.1 ± 46.1 $437.1 \pm 7.4.0$ 460.9 ± 59.3 Calcium (mg) 823.1 ± 83.0 937.2 ± 76.8 551.4 ± 49.4 675.8 ± 72.1 $r = 0.463$ $P = 0.001$ Men 859.7 ± 12.7 942.5 ± 112.9 496.6 ± 71.2 718.2 ± 114.1 $P = 0.002$ Women $1.507.6 \pm 198.3$ $1.633.9 \pm 179.8$ $1.053.2 \pm 48.4$ $1.200.4 \pm 84.6$ $r = 0.448$ $P = 0.020$ Men 2.01 ± 3.0 21.4 ± 2.4 1.47 ± 1.7 16.5 ± 1.5 $1.633.8 \pm 19.9$ $r = 0.448$ $P = 0.020$ Men 2.01 ± 3.0 21.4 ± 2.4 1.47 ± 1.7 $11.7 \pm 7.2.3$ <	Percent calories from carbohydrate (%)	61.6 ± 1.9	62.9 ± 1.2	53.5 ± 1.9	50.1 ± 1.2		
Men 30.6 ± 4.4 35.4 ± 4.4 16.9 ± 1.8 18.1 ± 1.7 Women 31.0 ± 5.7 32.5 ± 4.3 17.2 ± 2.1 17.3 ± 1.8 Cholesterol (mg) 366.0 ± 34.4 414.0 ± 38.6 366.7 ± 46.2 453.8 ± 36.7 $r = 0.061$ $P = 0.691$ Men 439.4 ± 47.1 437.6 ± 59.3 361.3 ± 99.1 441.5 ± 47.7 Women 282.1 ± 27.9 383.1 ± 45.1 437.1 ± 74.0 460.9 ± 59.3 Calcium (mg) 823.1 ± 83.0 937.2 ± 76.8 551.4 ± 40.4 676.8 ± 72.1 $r = 0.463$ $P = 0.001$ Men 850.7 ± 122.7 942.5 ± 112.9 496.8 ± 71.2 718.2 ± 114.1 $W = 0.002$ Men $1.507.6 \pm 198.3$ $1.533.9 \pm 179.8$ $1.032.8 \pm 84.4$ $1.276.5 \pm 127.5$ $W = 0.002$ Mon 21.24 ± 2.1 21.1 ± 21.7 18.7 ± 2.3 $P = 0.022$ $P = 0.022$ Men $1.201.4 \pm 16.9$ $1.436.3 \pm 149.5$ $1.934.4 \pm 153.9$ $r = 0.327$ $P = 0.024$ Men $1.281.4 \pm 10.7$ $1.87.4 \pm 24$ 1	Fiber (g)	30.8 ± 3.4	34.2 ± 3.1	17.0 ± 1.3	17.8 ± 1.2	r = 0.404	P = 0.006
Women 31.0 ± 5.7 32.5 ± 4.3 17.2 ± 2.1 17.3 ± 1.8 Cholesteru (mg) 366.0 ± 34.4 414.0 ± 38.6 396.7 ± 46.2 453.8 ± 36.7 $r=0.061$ $P=0.691$ Men 439.4 ± 47.1 437.6 ± 59.3 361.3 ± 59.1 $4415.447.7$ $r=0.061$ $P=0.691$ Women 282.1 ± 27.9 383.1 ± 46.1 497.1 ± 74.0 469.9 ± 59.3 $r=0.463$ $P=0.001$ Men 859.7 ± 12.37 942.5 ± 112.9 496.8 ± 71.2 718.2 ± 114.1 $r=0.463$ $P=0.001$ Women 781.4 ± 116.2 390.4 ± 103.3 613.7 ± 65.0 620.2 ± 76.3 $P=0.002$ Men $1.507.6\pm198.3$ $1.633.9\pm179.8$ $1.053.2\pm88.4$ $1.276.5\pm127.5$ $P=0.002$ Women $1.281.4\pm159.9$ $1.436.3\pm144.62$ $1.033.6\pm64.0$ $1.100.8\pm100.8$ $P=0.002$ Men $1.507.6\pm198.3$ $1.633.9\pm179.8$ $1.053.2\pm88.4$ $1.276.5\pm127.5$ $P=0.022$ Mon 2.0 ± 3.2 2.0 ± 2.5 14.3 ± 1.1 $1.79.\pm3.4$ $T=0.327$ $P=0.022$ Men 2.0 ± 3.2 2.0 ± 2.5 14.3 ± 1.1 17.9 ± 3.4 $T=0.062$ $P=0.068$ Men 14.0 ± 1.8 15.5 ± 1.5 9.9 ± 1.0 12.8 ± 1.4 9.3 ± 0.8 $S0diut$ $r=0.258$ $P=0.068$ Men 12.2 ± 1.0 $1.37.2\pm6.62.1$ $6.068.2\pm537.9$ $3.668.4\pm217.1$ $4.168.3\pm12.9$ $r=0.258$ $P=0.068$ Men $3.688.5\pm382.9$ $4.512.6\pm412.2$ $2.276.7\pm90.0$ $2.521.2\pm151.0$ $r=0.258$ $P=0.024$ Men $3.688.5\pm382.9$ $4.512.6\pm412.2$ 2.2	Men	30.6 ± 4.4	35.4 ± 4.4	16.9±1.8	18.1 ± 1.7		
Onlesserol (mg) 366.0 ± 34.4 414.0 ± 38.6 396.7 ± 46.2 453.8 ± 36.7 r = 0.061 P = 0.691 Men 439.4 ± 47.1 437.6 ± 50.3 361.3 ± 50.1 441.5 ± 47.7 Women 282.1 ± 27.9 383.1 ± 45.1 437.1 ± 74.0 469.9 ± 59.3 Calclum (mg) 823.1 ± 82.0 937.2 ± 76.8 551.4 ± 49.4 675.8 ± 72.1 r = 0.463 P = 0.001 Men 869.7 ± 123.7 942.5 ± 112.9 466.8 ± 71.2 718.2 ± 114.1 Women 781.4 ± 116.2 930.4 ± 103.3 613.7 ± 66.0 620.2 ± 76.3 P = 0.002 Men 1.507.6 ± 198.3 1.633.9 ± 179.8 1.053.2 ± 88.4 1.276.5 ± 127.5 P = 0.022 N = 0.327 P = 0.022 Men 1.201.4 ± 30.2 21.4 ± 2.4 14.7 ± 1.1 11.0 ± 31.4 N = 0.327 P = 0.022 Men 20.1 ± 30.2 21.4 ± 2.4 14.5 ± 1.0 11.3 ± 1.9 r = 0.282 Men 20.	Women	31.0 ± 5.7	32.5 ± 4.3	17.2 ± 2.1	17.3 ± 1.8		
Men 439.4 ± 47.1 437.6 ± 59.3 351.3 ± 59.1 441.5 ± 47.7 Women 282.1 ± 27.9 383.1 ± 45.1 437.1 ± 74.0 499.9 ± 50.3 Calclum (mg) 823.1 ± 83.0 937.2 ± 76.8 561.4 ± 49.4 675.8 ± 72.1 r = 0.463 P = 0.001 Men 859.7 ± 123.7 942.5 ± 112.9 496.8 ± 71.2 718.2 ± 114.1 1 Women 781.4 ± 116.2 930.4 ± 103.3 613.7 ± 65.0 620.2 ± 76.3 P = 0.003 Men 1.507.6 ± 198.3 1.633.9 ± 179.8 1.003.8 ± 68.4 1.276.5 ± 127.5 Women 1.281.4 ± 159.9 1.436.3 ± 146.2 1.003.8 ± 66.4 1.100.8 ± 100.8 I	Cholesterol (ma)	366 0 + 34 4	414.0 + 38.6	396 7 + 46 2	453 8 + 36 7	r = 0.061	P = 0.691
Women 282.1±27.9 333.1±45.1 437.1±74.0 469.9±95.3 Caldum (mg) 823.1±83.0 937.2±76.8 551.4±494. 675.8±72.1 r=0.463 P=0.001 Men 859.7±12.37 942.5±112.9 496.8±71.2 718.2±114.1 r=0.463 P=0.001 Women 781.4±116.2 930.4±01.03.3 613.7±65.0 620.2±76.3 r=0.448 P=0.002 Men 1.507.6±198.3 1.633.9±179.8 1.053.2±88.4 1.200.4±84.6 r=0.448 P=0.002 Men 1.201.4±128.5 1.548.3±119.5 1.044.0±53.9 1.200.4±84.6 r=0.448 P=0.002 Men 1.607.6±198.3 1.633.9±179.8 1.053.2±88.4 1.276.5±127.5 Men Women 1.201.4±0.1 1.31.4±1.1 1.10.2±1.1 1.10.8±1.1 1.00.8±100.8 Women 1.201.4±1.3 2.1±1.2 1.1±2.1 1.13.2±0.9 r=0.062 P=0.062 Men 2.0±1.3 1.2±1.4 1.3±1.1 1.7±1.4 1.2±1.9 1.3±0.9 r=0.062 P=0.062 Men	Men	439 4 + 47 1	437 6 + 59 3	361 3 + 59 1	4415+477		
Trans Total 11/3 Total 11/3 Total 11/3 Total 11/3 Total 11/3 Calcium (mg) 823.1 ± 83.0 937.2 ± 76.8 551.4 ± 49.4 675.8 ± 72.1 r = 0.463 P = 0.001 Men 850.7 ± 123.7 942.5 ± 112.9 496.8 ± 71.2 718.2 ± 114.1 P = 0.001 Women 781.4 ± 116.2 930.4 ± 103.3 613.7 ± 65.0 620.2 ± 76.3 P Phosphorus (mg) 1.402.1 ± 128.6 1.548.4 ± 119.5 1.044.0 ± 53.9 1.200.4 ± 84.6 r = 0.448 P = 0.002 Men 1.201.4 ± 159.9 1.436.3 ± 149.2 1.033.6 ± 64.0 1.100.8 ± 100.8 P P 0.022 Men 2.01 ± 3.0 2.1 ± 4.2 1.437.1 18.3 ± 1.9 r = 0.327 P = 0.022 Men 1.8.9 ± 3.2 20.6 ± 2.5 14.3 ± 1.1 17.9 ± 3.4 Zinc (mg) 13.1 ± 1.1 14.7 ± 1.1 11.2 ± 1.9 11.3 ± 0.9 r = 0.052 P = 0.062 Men 1.40 ± 1.8 15.5 ± 1.5 9.9 ± 1.0 12.8 ± 1.4 Yia ± 1.4 Yia ± 1.4 Yia ± 1.4 Yia ± 1.4	Women	282 1 + 27 9	383 1 + 45 1	437 1 + 74 0	469 9 + 59 3		
Contain (hg)Contain (hg)<	Calcium (mg)	823 1 + 83 0	937.2 + 76.8	551 4 + 49 4	675.8 + 72.1	r = 0.463	P = 0.001
Momen7814 ± 116.290.62 ± 11.2.510.61 11.1.610.61 11.1.7Women7814 ± 116.290.42 ± 10.3.3613.7 ± 65.0620.2 ± 76.3Phosphorus (mg)1,402.1 ± 128.51,548.3 ± 119.51.044.0 ± 53.91,200.4 ± 84.6r = 0.448 $P = 0.002$ Men1,507.6 ± 198.31,633.9 ± 179.81,033.6 ± 84.41,276.5 ± 127.5rMomen1,281.4 ± 159.91,436.3 ± 146.21,033.6 ± 64.01,100.8 ± 100.8rIron (mg)19.5 ± 2.121.1 ± 1.714.5 ± 1.018.3 ± 1.9r = 0.327 $P = 0.022$ Men20.1 ± 3.021.4 ± 2.414.7 ± 1.718.7 ± 2.3rrWomen18.9 ± 3.220.6 ± 2.514.3 ± 1.117.9 ± 3.4rrZinc (mg)13.1 ± 1.114.7 ± 1.111.2 ± 1.911.3 ± 0.9r = 0.062 $P = 0.686$ Men14.0 ± 1.815.5 ± 1.59.9 ± 1.012.8 ± 1.4rrWomen12.1 ± 1.013.7 ± 1.612.8 ± 1.414.5 ± 8.250.2r = 0.258 $P = 0.067$ Men5,406.7 ± 1,114.95,670.6 ± 966.13,781.3 ± 292.43,736.3 ± 335.3P0.044Vomen3,686.8 ± 600.64,201.0 ± 494.02,316.3 ± 143.92,256.9 ± 161.8P0.042Momen1,327.6 ± 151.01,405.0 ± 155.9758.3 ± 74.392.93 ± 121.0r = 0.427 $P = 0.004$ Men1,434.5 ± 246.21,267.4 ± 171.0707.2 ± 135.8872.1 ± 195.7Women1.064.8 ± 152.01.145 ± 0.101.174 ± 0.15 <td>Men</td> <td>859 7 + 123 7</td> <td>942 5 + 112 9</td> <td>496 8 + 71 2</td> <td>718 2 + 114 1</td> <td>1 - 0.400</td> <td>1 - 0.001</td>	Men	859 7 + 123 7	942 5 + 112 9	496 8 + 71 2	718 2 + 114 1	1 - 0.400	1 - 0.001
Month101-11102300-1100310103101031010310103Men1,4021±128.51,548.3±119.51,044.0±53.91,200.4±84.6r=0.48 $P=0.002$ Men1,281.4±159.91,436.3±146.21,033.6±64.01,100.8±100.8r=0.327 $P=0.026$ Men20.1±3.021.4±2.414.7±1.118.3±1.9r=0.327 $P=0.026$ Men20.1±3.021.4±2.414.7±1.117.9±3.4Ten.(mg)r=0.622 $P=0.686$ Men18.9±3.220.6±2.514.3±1.117.9±3.4Ten.(mg)r=0.682 $P=0.686$ Men14.0±1.815.5±1.59.9±1.012.8±1.4Ten.(mg)r=0.682 $P=0.686$ Men14.0±1.815.5±1.59.9±1.012.8±1.4Ten.(mg)r=0.682 $P=0.686$ Men14.0±1.815.5±1.59.9±1.012.8±1.4Ten.(mg)r=0.682 $P=0.686$ Men5.532.6±842.86.372.2±613.83.569.6±331.14.483.7±347.4Ten.(mg)Men5.632.6±842.86.372.2±613.83.569.6±331.14.483.7±347.4Ten.(mg)Men3.868.5±382.94.512.6±412.22.276.7±90.02.521.2±151.0r=0.425 $P=0.004$ Men3.868.5±382.94.512.6±412.22.276.7±90.02.521.2±151.0r=0.425 $P=0.004$ Men3.868.5±382.94.512.6±412.22.276.7±90.02.521.2±151.0r=0.425 $P=0.004$ Men1.33.6±151.01.405.0±155.9758.3±74.3929.3±121.0r=0.425 $P=0.004$ <t< td=""><td>Women</td><td>781 / + 116 2</td><td>030.4 ± 103.3</td><td>430.0 ± 71.2</td><td>620.2 ± 76.3</td><td></td><td></td></t<>	Women	781 / + 116 2	030.4 ± 103.3	430.0 ± 71.2	620.2 ± 76.3		
Independence1,507,6 ± 198,31,503,9 ± 178,31,503,9 ± 178,31,503,6 ± 176,51,507,6 ± 127,5Women1,281,4 ± 159,91,436,3 ± 146,21,003,6 ± 64,01,100,8 ± 100,8Iron (mg)19,5 ± 2.121,1 ± 1,714,5 ± 1,018,3 ± 1,9r = 0.327 $P = 0.026$ Men20,1 ± 3,021,4 ± 2,414,7 ± 1,718,7 ± 2,3ZWomen18,9 ± 3,220,6 ± 2,514,3 ± 1,117,9 ± 3,4ZZinc (mg)13,1 ± 1,114,7 ± 1,111,2 ± 1,911,3 ± 0,9r = 0.062 $P = 0.682$ Men14,0 ± 1,815,5 ± 1,59,9 ± 1,012,8 ± 1,4ZZWomen12,1 ± 1,013,7 ± 1,612,8 ± 4,09,3 ± 0,8ZSodium (mg)5,473,8 ± 662,16,068,2 ± 537,93,668,4 ± 217,14,159,8 ± 50,2r = 0.258 $P = 0.067$ Men5,532,6 ± 842,86,372,2 ± 613,83,569,6 ± 331,14,483,7 ± 347,4WomenZZMonen5,406,7 ± 1,114,95,670,6 ± 966,13,781,3 ± 292,43,736,3 ± 335,3ZPotassium (mg)3,858,5 ± 382,94,512,6 ± 412,22,276,7 ± 99,02,521,2 ± 151,0r = 0.463 $P = 0.014$ Men3,849,5 ± 523,54,750,9 ± 628,82,242,0 ± 144,32,721,8 ± 219,4Women1,337,6 ± 151,01,405,0 ± 155,9758,3 ± 74,3929,3 ± 121,0r = 0.425 $P = 0.004$ Men1,344,5 ± 246,21,267,4 ± 171,0707,2 ± 135,8872,1 ± 195,7Women1,226,9 ± 171,31,564,9 ± 286,6816,	Phosphorus (mg)	1 /02 1 + 128 5	1 5/8 3 + 110 5	1 044 0 + 53 9	1 200 4 + 84 6	r = 0.448	P = 0.002
Men1,00.1 10.31,00.2 110.31,00.2 10.31,210.3 1121.3Women1,281.4 159.91,436.3 14621,036.4 64.01,100.8 ±10.8Iron (mg)19.5 ± 2.121.1 ± 1.714.5 ± 1.018.3 ± 1.9r = 0.327P = 0.026Men20.1 ± 3.021.4 ± 2.414.7 ± 1.718.7 ± 2.3P = 0.026Women18.9 ± 3.220.6 ± 2.514.3 ± 1.117.9 ± 3.4Zinc (mg)13.1 ± 1.114.7 ± 1.111.2 ± 1.911.3 ± 0.9r = 0.062P = 0.686Men14.0 ± 1.815.5 ± 1.59.9 ± 1.012.8 ± 1.4P = 0.062P = 0.686Women12.1 ± 1.013.7 ± 1.612.8 ± 4.09.3 ± 0.8P = 0.067Sodium (mg)5.473.8 ± 662.16.068.2 ± 537.93.668.4 ± 217.14.155.8 ± 250.2r = 0.258P = 0.067Men5.532.6 ± 842.86.372.2 ± 613.83.569.6 ± 331.14.483.7 ± 347.4P = 0.067Women5.406.7 ± 1.11.95.670.6 ± 966.13.781.3 ± 292.43.736.3 ± 335.3P = 0.014Men3.868.8 ± 862.54.750.9 ± 628.82.242.0 ± 144.32.721.8 ± 219.4P = 0.014Men3.868.8 ± 606.54.201.0 ± 494.02.316.3 ± 143.92.258.9 ± 181.8P = 0.014Men1.434.5 ± 246.21.267.4 ± 171.0772.2 ± 135.8872.1 ± 195.7P = 0.004Men1.96 ± 0.302.13 ± 0.26816.7 ± 44.11.004.1 ± 118.7P = 0.004Men1.69 ± 0.302.13 ± 0.26816.7 ± 44.11.004.1 ± 118.7P = 0.004	Men	$1,702.1 \pm 120.3$ 1 507 6 ± 108 3	1,040.0 ± 119.0	$1,044.0 \pm 30.0$	1,200.4 ± 04.0	1 - 0.440	7 - 0.002
Worder1,20.01,40.01,00.01,00.01,00.01,00.0Iron (mg)19.5 ± 2.1 21.1 ± 1.7 14.5 ± 1.0 18.3 ± 1.9 r = 0.327 $P = 0.026$ Men20.1 ± 3.0 21.4 ± 2.4 14.7 ± 1.7 18.7 ± 2.3 11.3 ± 0.9 r = 0.327 $P = 0.026$ Women18.9 ± 3.2 20.6 ± 2.5 14.3 ± 1.1 17.9 ± 3.4 11.3 ± 0.9 r = 0.062 $P = 0.062$ Men14.0 ± 1.8 15.5 ± 1.5 9.9 ± 1.0 12.8 ± 1.4 9.3 ± 0.8 500mmWomen12.1 ± 1.0 13.7 ± 1.6 12.8 ± 4.0 9.3 ± 0.8 500mmSodium (mg)5.473.8 ± 662.1 6.068.2 ± 537.9 3.668.4 ± 217.1 4.159.8 ± 250.2 r = 0.258 $P = 0.067$ Men5.532.6 \pm 842.86.372.2 \pm 613.83.569.6 \pm 331.14.483.7 \pm 347.44.483.7 \pm 347.44.483.7 \pm 347.4Women5.406.7 \pm 1.114.95.670.6 \pm 966.13.781.3 \pm 292.43.736.3 \pm 335.3 $P = 0.067$ Men3.868.5 \pm 382.94.512.6 \pm 412.22.276.7 \pm 99.02.521.2 \pm 151.0r = 0.363 $P = 0.067$ Men3.869.5 \pm 523.54.750.9 \pm 628.82.242.0 \pm 144.32.721.8 \pm 219.4 W Wormen3.868.5 \pm 606.54.201.0 \pm 494.02.316.3 \pm 143.92.258.9 \pm 181.8 V Vitamin A(ugRE)1.337.6 \pm 151.01.405.0 \pm 155.9756.3 \pm 74.3929.3 \pm 121.0r = 0.425 $P = 0.002$ Men1.96 \pm 0.302.13 \pm 0.261.46 \pm 0.231.61 \pm 0.16 W Men1.96 \pm 0.302.13	Women	$1,307.0 \pm 150.0$	1,000.9 ± 1/9.0	1,033.6 + 64.0	$1,270.3 \pm 127.3$		
India (ing)13.5 2.12.1.1 1.714.3 1.1310.3 1.13 <td></td> <td>10.5 + 2.1</td> <td>21.1 ± 1.7</td> <td>14.5 ± 1.0</td> <td>183+10</td> <td>r = 0.327</td> <td>P - 0.028</td>		10.5 + 2.1	21.1 ± 1.7	14.5 ± 1.0	183+10	r = 0.327	P - 0.028
Men18.9 ± 3.220.6 ± 2.514.3 ± 1.110.7 ± 2.3Zinc (mg)13.1 ± 1.114.7 ± 1.111.2 ± 1.911.3 ± 0.9r = 0.662 $P = 0.662$ Men14.0 ± 1.815.5 ± 1.59.9 ± 1.012.8 ± 1.4 $P = 0.662$ Women12.1 ± 1.013.7 ± 1.612.8 ± 4.09.3 ± 0.8Sodium (mg)5.473.8 ± 662.16.068.2 ± 537.93.668.4 ± 217.14.159.8 ± 250.2r = 0.258 $P = 0.062$ Men5.532.6 ± 842.86.372.2 ± 613.83.569.6 ± 331.14.483.7 ± 347.4 $P = 0.042$ Women5.406.7 ± 1.14.95.670.6 ± 966.13.781.3 ± 292.43.736.3 ± 335.3 $P = 0.014$ Potassium (mg)3.868.5 ± 382.94.512.6 ± 412.22.276.7 ± 90.02.521.2 ± 151.0r = 0.363 $P = 0.014$ Men3.849.5 ± 523.54.750.9 ± 628.82.242.0 ± 144.32.721.8 ± 219.4 $P = 0.014$ Women3.868.8 ± 606.54.201.0 ± 494.02.316.3 ± 143.92.258.9 ± 181.8 $P = 0.004$ Vitamin A(µgRE)1.337.6 ± 151.01.405.0 ± 155.9758.3 ± 74.3929.3 ± 121.0r = 0.425 $P = 0.003$ Men1.4226.9 ± 171.31.584.9 ± 282.6816.7 ± 44.11.004.1 ± 118.7 $P = 0.003$ Men1.96 ± 0.302.13 ± 0.261.46 ± 0.231.61 ± 0.16 $P = 0.004$ Men1.96 ± 0.302.13 ± 0.261.46 ± 0.231.61 ± 0.16 $P = 0.005$ Men1.96 ± 0.302.13 ± 0.261.46 ± 0.231.61 ± 0.16 $P = 0.005$ Men1.96 ± 0.301.73	Mon	20.1 + 3.0	21.1 ± 1.7	14.3 ± 1.0	187+23	1 - 0.521	7 - 0.020
Worlief 16.9 ± 3.2 20.6 ± 2.5 14.5 ± 1.1 17.9 ± 3.4 Zinc (mg) 13.1 ± 1.1 14.7 ± 1.1 11.2 ± 1.9 11.3 ± 0.9 $r = 0.062$ $P = 0.686$ Men 14.0 ± 1.8 15.5 ± 1.5 9.9 ± 1.0 12.8 ± 1.4 9.3 ± 0.8 Sodium (mg) $5.473.8 \pm 662.1$ $6.068.2 \pm 537.9$ $3.668.4 \pm 217.1$ $4.159.8 \pm 250.2$ $r = 0.258$ $P = 0.087$ Men $5.532.6 \pm 842.8$ $6.372.2 \pm 613.8$ $3.569.6 \pm 331.1$ $4.483.7 \pm 347.4$ $Vomen$ Women $5.406.7 \pm 1.114.9$ $5.670.6 \pm 966.1$ $3.781.3 \pm 292.4$ $3.736.3 \pm 335.3$ Potassium (mg) $3.858.5 \pm 382.9$ $4.512.6 \pm 412.2$ $2.276.7 \pm 99.0$ $2.521.2 \pm 151.0$ $r = 0.363$ $P = 0.014$ Men $3.849.5 \pm 523.5$ $4.750.9 \pm 628.8$ $2.242.0 \pm 144.3$ $2.721.8 \pm 219.4$ $Vomen$ Women $3.868.8 \pm 606.5$ $4.201.0 \pm 494.0$ $2.316.3 \pm 143.9$ $2.258.9 \pm 181.8$ Vitamin A(µgRE) $1.337.6 \pm 151.0$ $1.405.0 \pm 155.9$ 758.3 ± 74.3 929.3 ± 121.0 $r = 0.425$ $P = 0.004$ Men $1.226.9 \pm 171.3$ $1.884.9 \pm 282.6$ 816.7 ± 44.1 $1.004.1 \pm 118.7$ $Vitamin B_1$ $Vitamin B_1$ 1.99 ± 0.16 1.31 ± 0.13 1.42 ± 0.12 $r = 0.427$ $P = 0.005$ Men 1.96 ± 0.30 2.13 ± 0.26 1.46 ± 0.23 1.61 ± 0.16 $Vitamin B_2$ $Vitamin B_2 \pm 0.31$ 1.98 ± 0.16 1.31 ± 0.13 1.42 ± 0.12 $r = 0.361$ $P = 0.005$ Men 1.60 ± 0.15 1.78 ± 0.16 </td <td>Men</td> <td>20.1 ± 3.0</td> <td>21.4 ± 2.4</td> <td>14.7 ± 1.7</td> <td>10.7 ± 2.3</td> <td></td> <td></td>	Men	20.1 ± 3.0	21.4 ± 2.4	14.7 ± 1.7	10.7 ± 2.3		
Zill C (Hg)13.1 ± 1.114.7 ± 1.111.2 ± 1.911.3 ± 0.9 $r = 0.062$ </td <td></td> <td>10.9 ± 3.2</td> <td>20.0 ± 2.5</td> <td>14.3 ± 1.1</td> <td>11.9±3.4</td> <td></td> <td>D - 0 696</td>		10.9 ± 3.2	20.0 ± 2.5	14.3 ± 1.1	11.9±3.4		D - 0 696
Men14.0 ± 1.815.5 ± 1.5 9.9 ± 1.0 12.5 ± 1.4Women12.1 ± 1.013.7 ± 1.612.8 ± 4.0 9.3 ± 0.8 Sodium (mg)5,473.8 ± 662.16,068.2 ± 537.93,668.4 ± 217.14,159.8 ± 250.2 $r = 0.258$ $P = 0.087$ Men5,532.6 ± 842.86,372.2 ± 613.83,569.6 ± 331.14,483.7 ± 37.44Women5,406.7 ± 1,114.95,670.6 ± 966.13,781.3 ± 292.43,736.3 ± 335.3Potassium (mg)3,858.5 ± 382.94,512.6 ± 412.22,276.7 ± 99.02,521.2 ± 151.0 $r = 0.363$ $P = 0.014$ Men3,849.5 ± 523.54,750.9 ± 628.82,242.0 ± 144.32,721.8 ± 219.4 $P = 0.014$ Women3,868.8 ± 606.54,201.0 ± 494.02,316.3 ± 143.92,258.9 ± 181.8 $P = 0.0425$ Vitamin A(µgRE)1,337.6 ± 151.01,405.0 ± 155.9758.3 ± 74.3929.3 ± 121.0 $r = 0.425$ $P = 0.004$ Men1,434.5 ± 246.21,267.4 ± 171.0707.2 ± 135.8872.1 ± 195.7 $P = 0.004$ Men1,26.9 ± 171.31,584.9 ± 282.6816.7 ± 44.11,004.1 ± 118.7Vitamin B1 (mg)1.79 ± 0.181.98 ± 0.161.31 ± 0.131.42 ± 0.12 $r = 0.427$ $P = 0.005$ Men1.96 ± 0.302.13 ± 0.261.46 ± 0.231.61 ± 0.16 $P = 0.015$ Women1.60 ± 0.151.78 ± 0.161.15 ± 0.101.17 ± 0.15Vitamin B2 (mg)1.73 ± 0.161.83 ± 0.131.19 ± 0.071.41 ± 0.10 $r = 0.361$ $P = 0.015$ Men1.87 ± 0.271.8	Zinc (ing)	13.1±1.1	14.7 ± 1.1	11.2 ± 1.9	11.3 ± 0.9	1 = 0.062	P = 0.000
Women 12.1 ± 1.0 13.7 ± 1.6 12.8 ± 4.0 9.3 ± 0.8 Sodium (mg) $5,473.8\pm662.1$ $6,068.2\pm537.9$ $3,668.4\pm217.1$ $4,159.8\pm250.2$ $r=0.258$ $P=0.087$ Men $5,532.6\pm842.8$ $6,372.2\pm613.8$ $3,569.6\pm331.1$ $4,483.7\pm347.4$ 4483.7 ± 347.4 Women $5,406.7\pm1.114.9$ $5,670.6\pm966.1$ $3,781.3\pm292.4$ $3,736.3\pm335.3$ Potassium (mg) $3,858.5\pm382.9$ $4,512.6\pm412.2$ $2,276.7\pm99.0$ $2,521.2\pm151.0$ $r=0.363$ $P=0.014$ Men $3,849.5\pm523.5$ $4,750.9\pm628.8$ $2,242.0\pm144.3$ $2,721.8\pm219.4$ $P=0.014$ Women $3,868.8\pm606.5$ $4,201.0\pm494.0$ $2,316.3\pm143.9$ $2,258.9\pm181.8$ Vitamin A(µgRE) $1,337.6\pm151.0$ $1,405.0\pm155.9$ 758.3 ± 74.3 929.3 ± 121.0 $r=0.425$ $P=0.004$ Men $1,434.5\pm246.2$ $1,267.4\pm171.0$ 707.2 ± 135.8 872.1 ± 195.7 $P=0.004$ Women $1,226.9\pm171.3$ $1,584.9\pm282.6$ 816.7 ± 44.1 $1,004.1\pm118.7$ Vitamin B ₁ (mg) 1.79 ± 0.18 1.98 ± 0.16 1.31 ± 0.13 1.42 ± 0.12 $r=0.427$ $P=0.003$ Men 1.96 ± 0.30 2.13 ± 0.26 1.46 ± 0.23 1.61 ± 0.16 $P=0.015$ Vitamin B ₂ (mg) 1.73 ± 0.16 1.83 ± 0.13 1.19 ± 0.07 1.41 ± 0.10 $r=0.361$ P=0.015 $M=0$ 1.87 ± 0.27 1.87 ± 0.20 1.17 ± 0.13 1.52 ± 0.16 Women 1.60 ± 0.15 1.78 ± 0.16 1.15 ± 0.10 1.7 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 Vitamin B ₆ (mg) <td>Men</td> <td>14.0 ± 1.8</td> <td>15.5 ± 1.5</td> <td>9.9±1.0</td> <td>12.8 ± 1.4</td> <td></td> <td></td>	Men	14.0 ± 1.8	15.5 ± 1.5	9.9±1.0	12.8 ± 1.4		
Sodium (mg) $5,473.8\pm 662.1$ $6,068.2\pm 537.9$ $3,668.4\pm 217.1$ $4,159.8\pm 250.2$ $r=0.258$ $P=0.087$ Men $5,532.6\pm 842.8$ $6,372.2\pm 613.8$ $3,569.6\pm 331.1$ $4,483.7\pm 347.4$ Women $5,406.7\pm 1,114.9$ $5,670.6\pm 966.1$ $3,781.3\pm 292.4$ $3,736.3\pm 335.3$ Potassium (mg) $3,858.5\pm 382.9$ $4,512.6\pm 412.2$ $2,276.7\pm 99.0$ $2,521.2\pm 151.0$ $r=0.363$ $P=0.014$ Men $3,849.5\pm 523.5$ $4,750.9\pm 628.8$ $2,242.0\pm 144.3$ $2,721.8\pm 219.4$ $P=0.014$ Women $3,868.8\pm 606.5$ $4,201.0\pm 494.0$ $2,316.3\pm 143.9$ $2,258.9\pm 181.8$ Vitamin A(µgRE) $1,337.6\pm 151.0$ $1,405.0\pm 155.9$ 758.3 ± 74.3 929.3 ± 121.0 $r=0.425$ $P=0.004$ Men $1,434.5\pm 246.2$ $1,267.4\pm 171.0$ 707.2 ± 135.8 872.1 ± 195.7 $P=0.004$ Men $1,226.9\pm 171.3$ $1,584.9\pm 282.6$ 816.7 ± 44.1 $1,004.1\pm 118.7$ Vitamin B ₁ (mg) 1.79 ± 0.18 1.98 ± 0.16 1.31 ± 0.13 1.42 ± 0.12 $r=0.427$ $P=0.005$ Men 1.96 ± 0.30 2.13 ± 0.26 1.46 ± 0.23 1.61 ± 0.16 $P=0.015$ Vitamin B ₂ (mg) 1.73 ± 0.16 1.83 ± 0.13 1.19 ± 0.07 1.41 ± 0.10 $r=0.361$ $P=0.015$ Vitamin B ₂ (mg) 3.12 ± 0.27 1.87 ± 0.20 1.17 ± 0.15 1.52 ± 0.16 $P=0.015$ Women 1.69 ± 0.15 1.77 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 $P=0.015$ Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2	vvomen	12.1 ± 1.0	13.7 ± 1.6	12.8 ± 4.0	9.3±0.8		
Men $5,532.6\pm 842.8$ $6,372.2\pm 613.8$ $3,569.6\pm 331.1$ $4,483.7\pm 347.4$ Women $5,406.7\pm 1,114.9$ $5,670.6\pm 966.1$ $3,781.3\pm 292.4$ $3,736.3\pm 335.3$ Potassium (mg) $3,858.5\pm 382.9$ $4,512.6\pm 412.2$ $2,276.7\pm 99.0$ $2,521.2\pm 151.0$ $r=0.363$ $P=0.014$ Men $3,849.5\pm 523.5$ $4,750.9\pm 628.8$ $2,242.0\pm 144.3$ $2,721.8\pm 219.4$ $P=0.014$ Women $3,868.8\pm 606.5$ $4,201.0\pm 494.0$ $2,316.3\pm 143.9$ $2,258.9\pm 181.8$ Vitamin A(µgRE) $1,337.6\pm 151.0$ $1,405.0\pm 155.9$ 758.3 ± 74.3 929.3 ± 121.0 $r=0.425$ $P=0.004$ Men $1,434.5\pm 246.2$ $1,267.4\pm 171.0$ 707.2 ± 135.8 872.1 ± 195.7 $P=0.004$ Women $1,226.9\pm 171.3$ $1,584.9\pm 282.6$ 816.7 ± 44.1 $1,004.1\pm 118.7$ Vitamin B ₁ (mg) 1.79 ± 0.18 1.98 ± 0.16 1.31 ± 0.13 1.42 ± 0.12 $r=0.427$ $P=0.003$ Men 1.96 ± 0.30 2.13 ± 0.26 1.46 ± 0.23 1.61 ± 0.16 $P=0.015$ Men 1.60 ± 0.15 1.78 ± 0.16 1.15 ± 0.10 1.17 ± 0.15 $P=0.015$ Vitamin B ₂ (mg) 1.73 ± 0.16 1.83 ± 0.13 1.19 ± 0.07 1.41 ± 0.10 $r=0.361$ $P=0.015$ Men 1.87 ± 0.27 1.87 ± 0.20 1.17 ± 0.13 1.52 ± 0.16 $P=0.015$ Men 1.57 ± 0.15 1.77 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 $P=0.014$ Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 $P=0.014$ Men <t< td=""><td>Sodium (mg)</td><td>5,473.8±662.1</td><td>6,068.2 ± 537.9</td><td>3,668.4 ± 217.1</td><td>4,159.8 ± 250.2</td><td>r = 0.258</td><td>P = 0.087</td></t<>	Sodium (mg)	5,473.8±662.1	6,068.2 ± 537.9	3,668.4 ± 217.1	4,159.8 ± 250.2	r = 0.258	P = 0.087
Women $5,406.7 \pm 1,114.9$ $5,670.6 \pm 966.1$ $3,781.3 \pm 292.4$ $3,736.3 \pm 335.3$ Potassium (mg) $3,858.5 \pm 382.9$ $4,512.6 \pm 412.2$ $2,276.7 \pm 99.0$ $2,521.2 \pm 151.0$ $r = 0.363$ $P = 0.014$ Men $3,849.5 \pm 523.5$ $4,750.9 \pm 628.8$ $2,242.0 \pm 144.3$ $2,721.8 \pm 219.4$ $r = 0.363$ $P = 0.014$ Women $3,868.8 \pm 606.5$ $4,201.0 \pm 494.0$ $2,316.3 \pm 143.9$ $2,258.9 \pm 181.8$ $r = 0.425$ $P = 0.004$ Vitamin A(µgRE) $1,337.6 \pm 151.0$ $1,405.0 \pm 155.9$ 758.3 ± 74.3 929.3 ± 121.0 $r = 0.425$ $P = 0.004$ Men $1,434.5 \pm 246.2$ $1,267.4 \pm 171.0$ 707.2 ± 135.8 872.1 ± 195.7 $P = 0.004$ Women $1,226.9 \pm 171.3$ $1,584.9 \pm 282.6$ 816.7 ± 44.1 $1,004.1 \pm 118.7$ Vitamin B ₁ (mg) 1.79 ± 0.18 1.98 ± 0.16 1.31 ± 0.13 1.42 ± 0.12 $r = 0.427$ $P = 0.003$ Men 1.96 ± 0.30 2.13 ± 0.26 1.46 ± 0.23 1.61 ± 0.16 $P = 0.015$ Men 1.60 ± 0.15 1.78 ± 0.16 1.15 ± 0.10 1.17 ± 0.15 $P = 0.015$ Men 1.87 ± 0.27 1.87 ± 0.20 1.17 ± 0.13 1.52 ± 0.16 $P = 0.015$ Men 1.57 ± 0.15 1.77 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 $P = 0.015$ Men 1.57 ± 0.15 1.77 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 $P = 0.014$ Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 Women 2.98 ± 0.34 $3.$	Men	5,532.6 ± 842.8	6,372.2 ± 613.8	3,569.6 ± 331.1	4,483.7 ± 347.4		
Potassium (mg) $3,858.5 \pm 382.9$ $4,512.6 \pm 412.2$ $2,276.7 \pm 99.0$ $2,521.2 \pm 151.0$ $r = 0.363$ $P = 0.014$ Men $3,849.5 \pm 523.5$ $4,750.9 \pm 628.8$ $2,242.0 \pm 144.3$ $2,721.8 \pm 219.4$ Women $3,868.8 \pm 606.5$ $4,201.0 \pm 494.0$ $2,316.3 \pm 143.9$ $2,258.9 \pm 181.8$ Vitamin A(µgRE) $1,337.6 \pm 151.0$ $1,405.0 \pm 155.9$ 758.3 ± 74.3 929.3 ± 121.0 $r = 0.425$ $P = 0.004$ Men $1,434.5 \pm 246.2$ $1,267.4 \pm 171.0$ 707.2 ± 135.8 872.1 ± 195.7 $r = 0.425$ $P = 0.004$ Men $1,226.9 \pm 171.3$ $1,584.9 \pm 282.6$ 816.7 ± 44.1 $1,004.1 \pm 118.7$ $r = 0.427$ $P = 0.003$ Men 1.96 ± 0.30 2.13 ± 0.26 1.46 ± 0.23 1.61 ± 0.16 $r = 0.427$ $P = 0.003$ Men 1.96 ± 0.30 2.13 ± 0.26 1.46 ± 0.23 1.61 ± 0.16 $r = 0.361$ $P = 0.004$ Men 1.60 ± 0.15 1.78 ± 0.16 1.15 ± 0.10 1.17 ± 0.15 $r = 0.361$ $P = 0.003$ Men 1.60 ± 0.15 1.78 ± 0.16 1.15 ± 0.10 1.17 ± 0.15 $P = 0.015$ Men 1.67 ± 0.27 1.87 ± 0.20 1.17 ± 0.13 1.52 ± 0.16 Women 1.57 ± 0.15 1.77 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 Women 2.98 ± 0.34 3.05 ± 0.31 1.86 ± 0.12 2.40 ± 0.42	Women	5,406.7 ± 1,114.9	5,670.6 ± 966.1	3,781.3 ± 292.4	3,736.3 ± 335.3		
Men $3,849.5\pm523.5$ $4,750.9\pm628.8$ $2,242.0\pm144.3$ $2,721.8\pm219.4$ Women $3,868.8\pm606.5$ $4,201.0\pm494.0$ $2,316.3\pm143.9$ $2,258.9\pm181.8$ Vitamin A(µgRE) $1,337.6\pm151.0$ $1,405.0\pm155.9$ 758.3 ± 74.3 929.3 ± 121.0 $r=0.425$ $P=0.004$ Men $1,434.5\pm246.2$ $1,267.4\pm171.0$ 707.2 ± 135.8 872.1 ± 195.7 $P=0.004$ Women $1,226.9\pm171.3$ $1,584.9\pm282.6$ 816.7 ± 44.1 $1,004.1\pm118.7$ Vitamin B1 (mg) 1.79 ± 0.18 1.98 ± 0.16 1.31 ± 0.13 1.42 ± 0.12 $r=0.427$ $P=0.003$ Men 1.96 ± 0.30 2.13 ± 0.26 1.46 ± 0.23 1.61 ± 0.16 1.17 ± 0.15 Women 1.60 ± 0.15 1.78 ± 0.16 1.15 ± 0.10 1.17 ± 0.15 $P=0.015$ Men 1.87 ± 0.27 1.87 ± 0.20 1.17 ± 0.13 1.52 ± 0.16 $P=0.015$ Men 1.57 ± 0.15 1.77 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 $P=0.011$ Men 3.12 ± 0.29 3.29 ± 0.26 2.06 ± 0.12 2.46 ± 0.22 $r=0.374$ $P=0.011$ Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 $P=0.011$ Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 $P=0.011$ Men 3.25 ± 0.47 3.05 ± 0.31 1.86 ± 0.12 2.40 ± 0.42 $P=0.011$	Potassium (mg)	3,858.5 ± 382.9	4,512.6 ± 412.2	2,276.7 ± 99.0	2,521.2 ± 151.0	r = 0.363	<i>P</i> = 0.014
Women3,868.8 \pm 606.54,201.0 \pm 494.02,316.3 \pm 143.92,258.9 \pm 181.8Vitamin A(µgRE)1,337.6 \pm 151.01,405.0 \pm 155.9758.3 \pm 74.3929.3 \pm 121.0 $r = 0.425$ $P = 0.004$ Men1,434.5 \pm 246.21,267.4 \pm 171.0707.2 \pm 135.8872.1 \pm 195.7Women1,226.9 \pm 171.31,584.9 \pm 282.6816.7 \pm 44.11,004.1 \pm 118.7Vitamin B1 (mg)1.79 \pm 0.181.98 \pm 0.161.31 \pm 0.131.42 \pm 0.12 $r = 0.427$ $P = 0.004$ Men1.96 \pm 0.302.13 \pm 0.261.46 \pm 0.231.61 \pm 0.161.61 \pm 0.161.17 \pm 0.15Women1.60 \pm 0.151.78 \pm 0.161.15 \pm 0.101.17 \pm 0.151.72 \pm 0.12 $r = 0.361$ $P = 0.015$ Men1.87 \pm 0.271.87 \pm 0.201.17 \pm 0.131.52 \pm 0.161.52 \pm 0.161.52 \pm 0.161.52 \pm 0.16Women1.57 \pm 0.151.77 \pm 0.151.22 \pm 0.071.26 \pm 0.101.79 \pm 0.24 = 0.22 $r = 0.374$ $P = 0.011$ Men3.25 \pm 0.473.47 \pm 0.402.23 \pm 0.192.51 \pm 0.231.51 \pm 0.23Women2.98 \pm 0.343.05 \pm 0.311.86 \pm 0.122.40 \pm 0.421.51 \pm 0.24	Men	3,849.5 ± 523.5	$4,750.9 \pm 628.8$	2,242.0 ± 144.3	2,721.8 ± 219.4		
Vitamin A(μ gRE)1,337.6 ± 151.01,405.0 ± 155.9758.3 ± 74.3929.3 ± 121.0r = 0.425 $P = 0.004$ Men1,434.5 ± 246.21,267.4 ± 171.0707.2 ± 135.8872.1 ± 195.7Women1,226.9 ± 171.31,584.9 ± 282.6816.7 ± 44.11,004.1 ± 118.7Vitamin B1 (mg)1.79 ± 0.181.98 ± 0.161.31 ± 0.131.42 ± 0.12 $r = 0.427$ $P = 0.003$ Men1.96 ± 0.302.13 ± 0.261.46 ± 0.231.61 ± 0.161.17 ± 0.15Women1.60 ± 0.151.78 ± 0.161.15 ± 0.101.17 ± 0.15Vitamin B2 (mg)1.73 ± 0.161.83 ± 0.131.19 ± 0.071.41 ± 0.10 $r = 0.361$ $P = 0.015$ Men1.87 ± 0.271.87 ± 0.201.17 ± 0.131.52 ± 0.161.52 ± 0.161.51 ± 0.101.52 ± 0.16Women1.57 ± 0.151.77 ± 0.151.22 ± 0.071.26 ± 0.101.61 ± 0.101.61 ± 0.10Women2.98 ± 0.343.05 ± 0.311.86 ± 0.122.40 ± 0.421.51 ± 0.23	Women	3,868.8 ± 606.5	4,201.0 ± 494.0	2,316.3 ± 143.9	2,258.9 ± 181.8		
Men $1,434.5\pm246.2$ $1,267.4\pm171.0$ 707.2 ± 135.8 872.1 ± 195.7 Women $1,226.9\pm171.3$ $1,584.9\pm282.6$ 816.7 ± 44.1 $1,004.1\pm118.7$ Vitamin B1 (mg) 1.79 ± 0.18 1.98 ± 0.16 1.31 ± 0.13 1.42 ± 0.12 $r=0.427$ $P=0.003$ Men 1.96 ± 0.30 2.13 ± 0.26 1.46 ± 0.23 1.61 ± 0.16 Women 1.60 ± 0.15 1.78 ± 0.16 1.15 ± 0.10 1.17 ± 0.15 Vitamin B2 (mg) 1.73 ± 0.16 1.83 ± 0.13 1.19 ± 0.07 1.41 ± 0.10 $r=0.361$ Men 1.87 ± 0.27 1.87 ± 0.20 1.17 ± 0.13 1.52 ± 0.16 Women 1.57 ± 0.15 1.77 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 Men 3.12 ± 0.29 3.29 ± 0.26 2.06 ± 0.12 2.46 ± 0.22 $r=0.374$ Vitamin B6 (mg) 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 Women 2.98 ± 0.34 3.05 ± 0.31 1.86 ± 0.12 2.40 ± 0.42	Vitamin A(µgRE)	1,337.6 ± 151.0	1,405.0 ± 155.9	758.3 ± 74.3	929.3 ± 121.0	r = 0.425	<i>P</i> = 0.004
Women $1,226.9\pm171.3$ $1,584.9\pm282.6$ 816.7 ± 44.1 $1,004.1\pm118.7$ Vitamin B1 (mg) 1.79 ± 0.18 1.98 ± 0.16 1.31 ± 0.13 1.42 ± 0.12 $r=0.427$ $P=0.003$ Men 1.96 ± 0.30 2.13 ± 0.26 1.46 ± 0.23 1.61 ± 0.16 Women 1.60 ± 0.15 1.78 ± 0.16 1.15 ± 0.10 1.17 ± 0.15 Vitamin B2 (mg) 1.73 ± 0.16 1.83 ± 0.13 1.19 ± 0.07 1.41 ± 0.10 $r=0.361$ $P=0.015$ Men 1.87 ± 0.27 1.87 ± 0.20 1.17 ± 0.13 1.52 ± 0.16 $P=0.015$ Women 1.57 ± 0.15 1.77 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 $P=0.015$ Vitamin B6 (mg) 3.12 ± 0.29 3.29 ± 0.26 2.06 ± 0.12 2.46 ± 0.22 $r=0.374$ $P=0.011$ Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 $P=0.014$ Women 2.98 ± 0.34 3.05 ± 0.31 1.86 ± 0.12 2.40 ± 0.42 $P=0.014$	Men	1,434.5 ± 246.2	1,267.4 ± 171.0	707.2 ± 135.8	872.1 ± 195.7		
Vitamin B_1 (mg) 1.79 ± 0.18 1.98 ± 0.16 1.31 ± 0.13 1.42 ± 0.12 $r = 0.427$ $P = 0.003$ Men 1.96 ± 0.30 2.13 ± 0.26 1.46 ± 0.23 1.61 ± 0.16 Women 1.60 ± 0.15 1.78 ± 0.16 1.15 ± 0.10 1.17 ± 0.15 Vitamin B_2 (mg) 1.73 ± 0.16 1.83 ± 0.13 1.19 ± 0.07 1.41 ± 0.10 $r = 0.361$ $P = 0.015$ Men 1.87 ± 0.27 1.87 ± 0.20 1.17 ± 0.13 1.52 ± 0.16 $r = 0.361$ $P = 0.015$ Women 1.57 ± 0.15 1.77 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 $r = 0.374$ $P = 0.015$ Vitamin B_6 (mg) 3.12 ± 0.29 3.29 ± 0.26 2.06 ± 0.12 2.46 ± 0.22 $r = 0.374$ $P = 0.011$ Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 $P = 0.014$ Women 2.98 ± 0.34 3.05 ± 0.31 1.86 ± 0.12 2.40 ± 0.42	Women	1,226.9 ± 171.3	1,584.9 ± 282.6	816.7 ± 44.1	1,004.1 ± 118.7		
Men 1.96 ± 0.30 2.13 ± 0.26 1.46 ± 0.23 1.61 ± 0.16 Women 1.60 ± 0.15 1.78 ± 0.16 1.15 ± 0.10 1.17 ± 0.15 Vitamin B2 (mg) 1.73 ± 0.16 1.83 ± 0.13 1.19 ± 0.07 1.41 ± 0.10 $r = 0.361$ $P = 0.015$ Men 1.87 ± 0.27 1.87 ± 0.20 1.17 ± 0.13 1.52 ± 0.16 Women 1.57 ± 0.15 1.77 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 Vitamin B6 (mg) 3.12 ± 0.29 3.29 ± 0.26 2.06 ± 0.12 2.46 ± 0.22 $r = 0.374$ $P = 0.011$ Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 $P = 0.014$ Women 2.98 ± 0.34 3.05 ± 0.31 1.86 ± 0.12 2.40 ± 0.42	Vitamin B ₁ (mg)	1.79 ± 0.18	1.98 ± 0.16	1.31 ± 0.13	1.42 ± 0.12	r = 0.427	<i>P</i> = 0.003
Women 1.60 ± 0.15 1.78 ± 0.16 1.15 ± 0.10 1.17 ± 0.15 Vitamin B2 (mg) 1.73 ± 0.16 1.83 ± 0.13 1.19 ± 0.07 1.41 ± 0.10 $r = 0.361$ $P = 0.015$ Men 1.87 ± 0.27 1.87 ± 0.20 1.17 ± 0.13 1.52 ± 0.16 Women 1.57 ± 0.15 1.77 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 Vitamin B6 (mg) 3.12 ± 0.29 3.29 ± 0.26 2.06 ± 0.12 2.46 ± 0.22 $r = 0.374$ $P = 0.011$ Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 $P = 0.011$ Women 2.98 ± 0.34 3.05 ± 0.31 1.86 ± 0.12 2.40 ± 0.42	Men	1.96 ± 0.30	2.13 ± 0.26	1.46 ± 0.23	1.61 ± 0.16		
Vitamin B_2 (mg) 1.73 ± 0.16 1.83 ± 0.13 1.19 ± 0.07 1.41 ± 0.10 $r = 0.361$ $P = 0.015$ Men 1.87 ± 0.27 1.87 ± 0.20 1.17 ± 0.13 1.52 ± 0.16 Women 1.57 ± 0.15 1.77 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 Vitamin B_6 (mg) 3.12 ± 0.29 3.29 ± 0.26 2.06 ± 0.12 2.46 ± 0.22 $r = 0.374$ $P = 0.011$ Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 $P = 0.014$ Women 2.98 ± 0.34 3.05 ± 0.31 1.86 ± 0.12 2.40 ± 0.42	Women	1.60 ± 0.15	1.78 ± 0.16	1.15 ± 0.10	1.17 ± 0.15		
Men 1.87 ± 0.27 1.87 ± 0.20 1.17 ± 0.13 1.52 ± 0.16 Women 1.57 ± 0.15 1.77 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 Vitamin B ₆ (mg) 3.12 ± 0.29 3.29 ± 0.26 2.06 ± 0.12 2.46 ± 0.22 $r = 0.374$ $P = 0.011$ Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 Women 2.98 ± 0.34 3.05 ± 0.31 1.86 ± 0.12 2.40 ± 0.42	Vitamin B ₂ (mg)	1.73 ± 0.16	1.83 ± 0.13	1.19 ± 0.07	1.41 ± 0.10	r = 0.361	<i>P</i> = 0.015
Women 1.57 ± 0.15 1.77 ± 0.15 1.22 ± 0.07 1.26 ± 0.10 Vitamin B6 (mg) 3.12 ± 0.29 3.29 ± 0.26 2.06 ± 0.12 2.46 ± 0.22 $r = 0.374$ $P = 0.011$ Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 Women 2.98 ± 0.34 3.05 ± 0.31 1.86 ± 0.12 2.40 ± 0.42	Men	1.87 ± 0.27	1.87 ± 0.20	1.17 ± 0.13	1.52 ± 0.16		
Vitamin B6 (mg) 3.12 ± 0.29 3.29 ± 0.26 2.06 ± 0.12 2.46 ± 0.22 $r = 0.374$ $P = 0.011$ Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 Women 2.98 ± 0.34 3.05 ± 0.31 1.86 ± 0.12 2.40 ± 0.42	Women	1.57 ± 0.15	1.77 ± 0.15	1.22 ± 0.07	1.26 ± 0.10		
Men 3.25 ± 0.47 3.47 ± 0.40 2.23 ± 0.19 2.51 ± 0.23 Women 2.98 ± 0.34 3.05 ± 0.31 1.86 ± 0.12 2.40 ± 0.42	Vitamin B ₆ (mg)	3.12 ± 0.29	3.29 ± 0.26	2.06 ± 0.12	2.46 ± 0.22	r = 0.374	<i>P</i> = 0.011
Women 2.98 ± 0.34 3.05 ± 0.31 1.86 ± 0.12 2.40 ± 0.42	Men	3.25 ± 0.47	3.47 ± 0.40	2.23 ± 0.19	2.51 ± 0.23		
	Women	2.98 ± 0.34	3.05 ± 0.31	1.86 ± 0.12	2.40 ± 0.42		

Nutri	FFQ		3-day dietary record		Correlation between FFQ and Dietary record	
Nutrient	Normal weight (n = 15, men = 8, women = 7)	Obese (n = 30, men = 17, women = 13)	Normal weight (n = 15, men = 8, women = 7)	Obese (n = 30, men = 17, women = 13)	Correlation coefficient	P-value
Niacin (mg)	24.8 ± 2.5	25.4 ± 2.1	18.0 ± 1.6	19.3 ± 1.7	r = 0.346	<i>P</i> = 0.020
Men	27.3 ± 4.1	27.2 ± 3.4	20.0 ± 2.8	21.6 ± 2.6		
Women	21.9 ± 2.6	23.2 ± 2.1	15.7 ± 0.7	16.4 ± 1.6		
Vitamin C (mg)	214.6 ± 25.7	308.6 ± 44.6	82.3 ± 9.7	75.9 ± 6.4	r = 0.252	<i>P</i> = 0.095
Men	210.7 ± 41.9	337.4 ± 74.0	85.9 ± 16.0	75.8 ± 8.8		
Women	219.1 ± 75.6	271.0 ± 36.5	78.2 ± 11.3	75.9 ± 9.5		
Folate (mg)	404.2 ± 46.7	411.7 ± 37.7	204.6 ± 16.9	244.1 ± 22.3	r = 0.164	<i>P</i> = 0.281
Men	398.4 ± 62.3	401.0 ± 52.5	199.0 ± 28.4	253.2 ± 34.0		
Women	410.7 ± 75.6	425.6 ± 55.4	210.9 ± 18.6	232.3 ± 27.0		
Vitamin E (mg)	14.5 ± 1.5	15.7 ± 1.4	17.4 ± 1.7	16.4 ± 1.1	r = 0.252	P=0.096
Men	15.3 ± 2.4	15.5 ± 1.9	16.7 ± 2.2	17.4 ± 1.7		
Women	13.6 ± 1.7	15.9 ± 2.0	18.3 ± 3.0	15.0 ± 1.2		

Values are means \pm SEM.

* Significantly different from the normal weight group by the Student's *t*-test (P=0.032).

[#]Tended to be different from the normal weight group by ANOVA (P=0.065).

Correlation was determined by a Pearson correlation,

FFQ, Food frequency questionnaire

the two groups. Although obese group's total and LDL-cholesterol levels and triglycerides were significantly higher than those of the normal weight group, their average values were still within the normal range (Table 2). This is most likely due to the fact that the subjects were fairly young, most of them being in their 20s. When the number of subjects with abnormal levels of clinical parameters was counted, the obese group had a higher percentage of subjects with dyslipidemia and metabolic syndrome (Table 3). The number of people with metabolic syndrome and abnormal levels of total cholesterol was significantly different between the obese and normal weight groups, determined by Chi-square test.

Serum free fatty acid level

Serum free fatty acid (FFA) levels tended to be higher in the obese group $(330.6 \pm 28.6 \text{ Eu/L})$ than in the normal weight group $(265.8 \pm 21.0 \text{ Eu/L}, P = 0.087; \text{ Fig. 1})$. Overall, women had higher levels than men (P = 0.040), but this difference was due to the very high levels in women in the obese group. In the normal weight group, there was no significant difference in FFA levels between men and women $(244.3 \pm 35.0 \text{ Eu/L} \text{ and } 290 \pm 19.3 \text{ Eu/L}$, respectively). In the obese group, women had significantly higher FFA levels than men $(275.4 \pm 21.8 \text{ Eu/L} \text{ and } 402.7 \pm 54.5 \text{ Eu/L}$, respectively, P = 0.025). Serum FFA showed a significantly positive correlation with fat mass in the obese group (r = 0.416, P = 0.022) but not in the normal weight group (r = -0.015, P = 0.959).

Comparison of nutrient intake in obese and normal weight groups

The nutrient intakes assessed by the FFQ and 3-day dietary record are shown in Table 4. No significant difference in nutrient

intake between the obese and normal weight subjects was found from the FFQ. Differences in the intake of several nutrients were found between men and women with the FFQ. Carbohydrate intake was significantly higher for men than women (477.3 ± 40.1 g and 355.4 ± 29.2 g, respectively, P = 0.041). Energy (2975.2 ± 234.7 kcal in men and 2331.6 ± 180.4 kcal in women, P = 0.059) and cholesterol (438.2 ± 42.4 mg in men and 347.8 ± 32.3 mg in women, P = 0.082) intakes tended to be higher for men than women.

Nutrient intake measured with a 3-day dietary record showed that the absolute amount of fat intake tended to be higher for obese subjects than normal weight subjects (82.0 ± 7.4 g and 60.5 ± 4.2 g, respectively, P = 0.065). The percent of calories from fat was significantly higher in the obese group ($33.7 \pm 1.8\%$ in obese subjects and $27.8 \pm 1.3\%$ in normal weight subjects, P = 0.032). Overall, vitamin B₁ intake was significantly higher in men (1.56 ± 0.13 mg in men and 1.16 ± 0.10 mg in women, P = 0.045), and niacin intake tended to be higher in men (21.1 ± 2.0 mg in men and 16.2 ± 1.0 mg in women, P = 0.073). The FFQ and 3-day dietary record showed strong correlation (P < 0.05) for energy, protein, carbohydrate, fiber, calcium, phosphorus, iron, potassium, vitamin A, vitamin B₁, vitamin B₂, vitamin B₆, and niacin intakes (Table 4).

All of the nutrient intake levels determined from the FFQ were above the dietary reference intakes for Koreans (2010). However, energy, fiber, folate, and vitamin C intake levels from the 3-day dietary record were below the dietary reference intakes for Koreans. The levels of vitamin A and vitamin B_2 intake from the 3-day dietary record were below the dietary reference intakes for Koreans only for normal weight men. Potassium intake from the 3-day dietary record was below adequate intake for Koreans.



Fig. 1. Serum free fatty acid levels of obese and normal weight subjects. Bars with different letters are significantly different at P < 0.05 by Fisher's Least-Significant-Difference test.



Fig. 2. Average reported alcohol consumption per drinking episode. *Significantly different from the normal weight group by Kruskal-Wallis nonparametric test (P< 0,05), Amount of alcohol consumed was calculated from the volume of the drink consumed and the percentage of alcohol in the drink.

Usual exercise pattern and alcohol consumption

The average frequency and duration of exercise in the study subjects did not differ significantly between the obese (2.6 times/wk, 1.1 hrs each time) and normal weight group (1.8 times/wk, 0.7 hr each time). The frequency of drinking episodes per week did not differ between obese and normal weight subjects (0.8 times/wk and 0.7 times/wk, respectively). However, the amount of alcohol consumed per drinking episode was significantly higher in the obese group (78.5 g in obese group and 41.5 g in normal weight group, P = 0.034) (Fig. 2). Men consumed significantly more alcohol than women in both groups (104.2 g and 44.8 g, respectively in the obese group and 60.8 g and 18.7 g, respectively in the normal weight group).

Discussion

In this study, we examined the clinical characteristics and nutrient intake of obese and normal weight adults, most of them in their 20's, to identify dietary factors contributing to obesity and the impact of obesity on otherwise healthy young adults. The results of serum lipid profiles and blood pressure levels in our study confirmed that obesity is associated with an increased risk of dyslipidemia and metabolic syndrome [13,14]. Obese subjects had significantly higher total cholesterol, LDL cholesterol, triglycerides, and blood pressure, and significantly lower HDL cholesterol than normal weight subjects. However, the average levels of serum lipids in the obese group were within the normal range, and the obese group did not have higher blood glucose levels than the normal weight group. This is likely due to the fact that subjects in this study were mostly (>85%) in their 20's.

Although the obese group's averages were within normal ranges, it is clear that obesity is associated with abnormal lipid metabolism and a higher risk of metabolic syndrome in young people. The percentage of subjects with abnormal lipid levels and blood pressure was higher in the obese group than the normal weight group. According to the diagnosis criteria for metabolic syndrome used by KNHANES, 26.7% of the subjects in the obese group of this study had metabolic syndrome, while none of the subjects in the normal weight group met the criteria. Results from the 2005 KNHANES reported that the prevalence of metabolic syndrome was 4.4% for Koreans in their 20's and 14.9% for those in their 30's. The prevalence of obesity in the same survey was reported to be 19.4% for Koreans in their 20ss and 29.0% for Koreans in their 30's [1]. Given the relatively low prevalence of metabolic syndrome reported in the 2005 KNHANES, even with obesity rates around 20 and 30%, the higher prevalence of metabolic syndrome reported in the obese group in this study demonstrates that obese young adults have the increased risk of developing metabolic syndrome.

An increased level of nonesterified FFA has been suggested as a possible mediator of insulin resistance and cardiovascular disease associated with obesity [15,16]. Overall, serum FFA levels tended to be higher in obese subjects in this study, mostly due to the high levels observed in the obese women. The significantly higher FFA levels in women in the obese group, even though fat mass was not significantly different between the genders, may pose a differential risk associated with obesity for women.

In this study, only a few dietary factors were shown to be significantly different between the obese and normal weight groups. The absolute amount of dietary fat intake from the 3-day dietary records tended to be higher in the obese group. When the percent of calories from fat was compared, obese subjects consumed significantly more calories from fat (about 20% more) than did normal weight subjects. Field *et al.* [17] observed a weak positive association between percent of calories from fat and weight gain in 41,518 women in a Nurses' Health Study, and calories from animal fat showed a stronger association. In this study, percent calories from animal fat consumed tended to be higher in the obese group. There are many dietary factors suggested to contribute to obesity, including eating frequency,

meat consumption, calories from protein, snack consumption, and skipping breakfast [3-8,18,19]. We did not observe any differences in snack consumption between obese and normal weight groups. In addition, there were no significant differences in the number of side dishes consumed between obese and normal weight subjects.

Nutrient intake assessed from the FFQ and 3-day dietary record showed strong correlations in energy, protein, carbohydrate, fiber, calcium, phosphorus, iron, potassium, vitamin A, vitamin B₁, vitamin B₂, vitamin B₆, and niacin intake. Crude correlation coefficients between the FFQ and dietary records in our study were comparable to the validation results from Ahn *et al.* [12], except for fat, cholesterol, zinc, sodium, vitamin C, folate, and vitamin E intake. Generally, nutrient intake assessed from the FFQ was higher than that assessed from the 3-day dietary record, except for vitamin E.

Energy intake was not significantly different between obese and normal weight subjects. Similar results have been reported in other studies [6,7,18]. A possible explanation may be an underreporting of dietary intake by obese subjects. Singh *et al.* [20] documented an increase in underreporting of dietary intake with increasing body weight in teens, determined from food records, total energy expenditure assessed using doubly labeled water, and metabolizable energy intake measured by bomb calorimetry. Weight management efforts of obese subjects via reduction of dietary intake may have also influenced their energy intake. Among the obese subjects in this study, 83% of them had tried to lose weight in the past by controlling dietary intake (52%), exercising (84%), and/or using alternative therapy or medication (12%).

Physical activity is an important factor in the regulation of energy balance and prevention of the development of obesity. Sedentary lifestyles have been associated with obesity [21,22]. In this study, the frequency and duration of exercise did not differ significantly between obese and normal weight subjects. Therefore, a sedentary lifestyle does not seem to be a major determinant of obesity in these subjects.

In this study, the amount of alcohol consumed per drinking episode was significantly higher in the obese group. The frequency of drinking episodes was similar for both groups. Conflicting results exist on the relationship between alcohol consumption and the development of obesity [23,24]. However, Yoon *et al.* [25], using 1998 KNHANES data, reported that abdominal obesity was positively associated with alcohol consumption in Korean adults with average ages of 44.2 (men) and 45.1 (women).

In conclusion, our study results suggest that obesity in otherwise healthy young adults is associated with disturbances in lipid metabolism and a greater risk of metabolic syndrome. Certain dietary factors, including higher fat intake and alcohol consumption, seem to be contributing to obesity in these subjects.

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References

- Ministry of Health & Welfare. In-depth Analysis on the 3rd (2005) Korea Health and Nutrition Examination Survey-Health Examination. Seoul: 2006.
- Calle EE, Thun MJ, Petrelli JM, Rodriguez C, Heath CW Jr. Body-mass index and mortality in a prospective cohort of U.S. adults. N Engl J Med 1999;341:1097-105.
- Wang Y, Beydoun MA. Meat consumption is associated with obesity and central obesity among US adults. Int J Obes (Lond) 2009;33:621-8.
- Murtaugh MA, Herrick JS, Sweeney C, Baumgartner KB, Guiliano AR, Byers T, Slattery ML. Diet composition and risk of overweight and obesity in women living in the southwestern United States. J Am Diet Assoc 2007;107:1311-21.
- Bes-Rastrollo M, Sanchez-Villegas A, Basterra-Gortari FJ, Nunez-Cordoba JM, Toledo E, Serrano-Martinez M. Prospective study of self-reported usual snacking and weight gain in a Mediterranean cohort: the SUN project. Clin Nutr 2010;29:323-30.
- Yoon JS, Lee NJ. Dietary patterns of obese high school girls: snack consumption and energy intake. Nutr Res Pract 2010;4: 433-7.
- Berg C, Lappas G, Wolk A, Strandhagen E, Torén K, Rosengren A, Thelle D, Lissner L. Eating patterns and portion size associated with obesity in a Swedish population. Appetite 2009;52:21-6.
- Howarth NC, Huang TT, Roberts SB, Lin BH, McCrory MA. Eating patterns and dietary composition in relation to BMI in younger and older adults. Int J Obes (Lond) 2007;31:675-84.
- Mills JP, Perry CD, Reicks M. Eating frequency is associated with energy intake but not obesity in midlife women. Obesity (Silver Spring) 2011;19:552-9.
- Ministry of Health & Welfare. Report on 2008 National Health and Nutrition Examination Survey-Health Examination. Seoul: 2009.
- Ahn J, Lee JE, Paik HY, Lee HK, Jo I, Kimm K. Development of a semi-quantitative food frequency questionnaire based on dietary data from the Korea national health and nutrition examination survey. Nutr Sci 2003;6:173-84.
- Ahn Y, Kwon E, Shim JE, Park MK, Joo Y, Kimm K, Park C, Kim DH. Validation and reproducibility of food frequency questionnaire for Korean genome epidemiologic study. Eur J Clin Nutr 2007;61:1435-41.
- Howard BV, Ruotolo G, Robbins DC. Obesity and dyslipidemia. Endocrinol Metab Clin North Am 2003;32:855-67.
- Brown CD, Higgins M, Donato KA, Rohde FC, Garrison R, Obarzanek E, Ernst ND, Horan M. Body mass index and the prevalence of hypertension and dyslipidemia. Obes Res 2000;8: 605-19.
- Van Gaal LF, Mertens IL, De Block CE. Mechanisms linking obesity with cardiovascular disease. Nature 2006;444:875-80.

- Mooradian AD, Haas MJ, Wehmeier KR, Wong NC. Obesityrelated changes in high-density lipoprotein metabolism. Obesity (Silver Spring) 2008;16:1152-60.
- Field AE, Willett WC, Lissner L, Colditz GA. Dietary fat and weight gain among women in the Nurses' Health Study. Obesity (Silver Spring) 2007;15:967-76.
- Hassapidou M, Fotiadou E, Maglara E, Papadopoulou SK. Energy intake, diet composition, energy expenditure, and body fatness of adolescents in northern Greece. Obesity (Silver Spring) 2006;14: 855-62.
- Woo J, Cheung B, Ho S, Sham A, Lam TH. Influence of dietary pattern on the development of overweight in a Chinese population. Eur J Clin Nutr 2008;62:480-7.
- Singh R, Martin BR, Hickey Y, Teegarden D, Campbell WW, Craig BA, Schoeller DA, Kerr DA, Weaver CM. Comparison of self-reported, measured, metabolizable energy intake with total energy expenditure in overweight teens. Am J Clin Nutr 2009;89: 1744-50.

- Choi B, Schnall PL, Yang H, Dobson M, Landsbergis P, Israel L, Karasek R, Baker D. Sedentary work, low physical job demand, and obesity in US workers. Am J Ind Med 2010;53: 1088-101.
- 22. Arsenault BJ, Rana JS, Lemieux I, Després JP, Kastelein JJ, Boekholdt SM, Wareham NJ, Khaw KT. Physical inactivity, abdominal obesity and risk of coronary heart disease in apparently healthy men and women. Int J Obes (Lond) 2010;34:340-7.
- Liu S, Serdula MK, Williamson DF, Mokdad AH, Byers T. A prospective study of alcohol intake and change in body weight among US adults. Am J Epidemiol 1994;140:912-20.
- Westerterp-Plantenga MS, Verwegen CR. The appetizing effect of an apéritif in overweight and normal-weight humans. Am J Clin Nutr 1999;69:205-12.
- 25. Yoon YS, Oh SW, Baik HW, Park HS, Kim WY. Alcohol consumption and the metabolic syndrome in Korean adults: the 1998 Korean National Health and Nutrition Examination Survey. Am J Clin Nutr 2004;80:217-24.