Original Article

Fast Food Consumption in Iranian Adults; Dietary Intake and Cardiovascular Risk Factors: Tehran Lipid and Glucose Study

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Abstract

Background: Although fast food consumption has drastically increased in Iran in recent years; there is a paucity of data in relation to the association between fast food consumption, dietary intake, and cardiovascular risk factors. This study aims to determine fast food consumption status among young and middle-aged Iranian adults, and to assess its impact on dietary intake and cardiovascular disease (CVD) risk factors.

Methods: This cross-sectional population-based study was conducted on 1944 young and middle-aged adults (840 men and 1104 women), who participated in the Tehran Lipid and Glucose Study (2006–2008). We collected dietary data by using a validated 168 item, semi-quantitative food frequency questionnaire. Total fast food consumption was calculated by summing up weekly consumption of the most commonly consumed fast foods in Iran.

Results: Mean consumption of fast food was 161g/week (95% CI: 147–175) for young adults and 108 g/week (95% CI: 101–115) for middle-aged adults. Mean dietary intakes of energy, fat, saturated fat, cholesterol, sodium, meat, and soft drinks increased significantly ($P < 0.05$), while carbohydrate and refined grain consumption decreased ($P < 0.01$) across tertiles of fast food in both age groups. In young adults, dietary energy density and protein intake increased significantly ($P < 0.01$) where as intake of non-starchy vegetables and carotenoids decreased ($P < 0.05$). In middle-aged adults dietary intakes of fiber, folate, calcium, and fruits significantly decreased across fast food tertiles ($P < 0.05$). After adjustment for confounders, there was an association between fast food consumption and body mass index (BMI; $\beta = 0.104$; $P < 0.01$) and waist circumference (WC; $\beta = 0.083$; $P < 0.01$) in young adults, and serum triglycerides ($\beta = 0.072$; $P < 0.05$), high density lipoprotein cholesterol (HDL-C; $\beta = -0.051$; $P < 0.05$), and atherogenic index of plasma ($\beta = 0.056$; $P < 0.05$) in middle-aged adults.

Conclusion: The results show that increased consumption of fast foods is associated with poor dietary intake and some of the CVD risk factors in Iranian adults.

Keywords: Cardiovascular disease, diet quality, fast food, Tehran Lipid and Glucose Study

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Introduction

According to reports by the World Health Organization (WHO), cardiovascular disease (CVD) is a rapidly increasing health problem that is the leading cause of death worldwide. CVD has caused 17.5 million deaths (30% of total deaths worldwide) in 2005, a figure which is expected to reach20 million deaths per year by 2015.[1] The prevalence of CVD in Iran is high; most people have at least one of the risk factors for CVD.[2] Dyslipidemia, obesity, diabetes mellitus, hypertension, and atherogenic diet are common risk factors for CVD.[1] Poor diet is considered one of the main causes for CVD; some studies have shown that, to a large extent, excessive consumption of fast food is responsible for decreased diet quality.[3,4]

Over the past decades fast food consumption has increased worldwide.[5–7] Fast foods are quick, convenient, relatively inexpensive, and liked by people of most age groups.[5] However, fast foods have high calorie densities; high contents of fat, sugar and salt; larger portion sizes; and palatability, all of which lead to weight gain and metabolic abnormalities such as insulin resistance.[8–10] Epidemiological and clinical studies have indicated that fast food consumption may be associated with a risk for CVD. These studies report that consumers of fast foods have higher intakes of energy, fat, saturated fatty acid (SFA), sodium, and carbonated soft drinks with fewer intakes of fruits, vegetables, milk, and vitamins C and A.[7] In the US, fast food consumption has increased from 2% of the energy intake in 1970 to 10% in 1990[11] and currently accounts for one-third of total energy intake.[9]

In recent years, although fast food consumption also has increased drastically among Iranians,[12,13] the data on fast food consumption in Iran is limited to assessments of the association between fast food and weight in children and adolescents; these results are inconsistent.[14–16] To our knowledge there are no data on the assessment of fast food consumption and its association with cardiovascular risk

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factors among Iranian adults.[13,17] This study aims to assess the association between fast food consumption, dietary intake, and CVD factors in young and middle-aged Iranian adults.

Materials and Methods

Participants

This study was conducted in a cross-sectional setting within the framework of the third phase (2006–2008) of the Tehran Lipid and Glucose Study (TLGS). A detailed description of the TLGS has been reported elsewhere.[18] Briefly, TLGS is a community-based, prospective study conducted to investigate and prevent non-communicable disease in a representative sample of residents, aged ≥ 3 years, from district 13 of Tehran, the capital of Iran. The first phase of the TLGS began in March 1999 and data collection is ongoing, at 3-year intervals.[19] Of 12523 subjects, aged ≥ 3 years in the third phase of the TLGS, 4920 were randomly selected for dietary assessment based on their sex and age; finally dietary data was obtained for 3462 (70%).[20] In the third phase of TLGS, there were 7005 subjects aged 19–50 years, of which 2167 subjects with complete dietary data were included in the current study. Subjects with dietary intake below 800 kcal/d energy intake (n = 104) or those with over 4200 kcal/d energy intake (n = 119) were excluded, following which the data of 1944 subjects (840 men and 1104 women) were analyzed. There was no significant difference between responders and non-responders in sex and age distribution.[21]

Dietary intake assessment and fast food intake estimation

Dietary data were collected using a validated semi-quantitative food frequency questionnaire with 168 food items.[22] Trained dietitians with at least 5 years of experience in the TLGS survey asked participants to report their consumption frequency for each food item consumed during the previous year on a daily, weekly, or monthly basis. Portion sizes of consumed foods that were reported in household measures were then converted to grams. The USDA Food Composition Table (FCT) was used to calculate energy and nutrient intakes.[23] The Iranian Food Composition Table[24] was used for national foods not listed in the USDA FCT. We designed an Excel program to analyze the nutrients of each food item. In the Excel sheet, all nutrients of each food item were formulated based on one gram of the respective food item. In this analysis, the most commonly consumed fast foods in Iran, including sausage, salami, hamburger, pizza,[25] and French fries were defined as fast foods. Total consumption of fast food for each subject was calculated by summing up the weekly consumption of these foods.

Clinical and biological measurements

Trained interviewers collected information using a pretested questionnaire.[19] Physical activity levels were assessed with the Krishka et al.[26] questionnaire. Weight was measured to the nearest 100 g by digital scales while the subjects were minimally clothed, without shoes. Height was measured to the nearest 0.5 cm, in a standing position without shoes, using a tape measure. Waist circumference (WC) was measured to the nearest 0.1 cm, at the umbilical level and that of the hip, at the maximum level over light clothing, using an unstretched tape measure, without any pressure on the body. Body mass index (BMI) was calculated as weight (kg) divided by the square of the height (m^2). For blood pressure measurements, after a 15-minute rest in the sitting position, 2 measurements were taken on the right arm, using a standardized mercury sphygmomanometer; the mean of the 2 measurements was considered as the participant's blood pressure. Fasting blood samples were taken after 12–14 hr, from all study participants. Fasting plasma glucose was measured by the enzymatic colorimetric method using glucose oxidase. Triglyceride level was measured by enzymatic colorimetric analysis with glycerol phosphate oxidase. High-density lipoprotein cholesterol (HDL-C) was measured after precipitation of the apolipoprotein B containing lipoproteins with phosphotungstic acid. Analyses were performed using Pars Azmoon kits (Pars Azmoon Inc., Tehran, Iran) and a Selectra 2 auto-analyzer (Vital Scientific, Spankeren, Netherlands). Inter- and intra- assay coefficients of variation of all assays was < 5%.[18]

Definition of terms

CVD risk factors were defined as follows: high total cholesterol (≥ 200 mg/dL), high serum triglycerides (≥ 150 mg/dL), and high blood pressure (≥ 140/90 mmHg).[19,27] Abdominal obesity was defined as WC ≥ 95 cm in men and women, according to the Iranian cutoff points.[28] Overweight and obesity were defined according to WHO definitions[29] as BMI 25–29.9 kg/m^2 for overweight and BMI > 30 kg/m^2 for obesity. The atherogenic index of plasma was defined as the logarithm of serum triglycerides/HDL-C ratio, which directly related to lipoprotein particle size and the risk of atherosclerosis.[30,31]

Statistical analysis

Statistical analysis was performed using SPSS (Version 16.0; Chicago, IL). $P < 0.05$ was considered significant. Energy-adjusted fast food consumption (g/1000 kcal/week) was assigned to tertiles in young (19–30 years) and middle-aged adults (31–50 years). Differences in general characteristics of participants that included age, smoking status, and physical activity, and in the prevalence of overweight, obesity, abdominal obesity, hypertriglyceridemia, hypercholesterolemia, and hypertension across fast food tertiles were compared by one-way ANOVA (analysis of variance) or the Chi-square test. Energy, nutrient and food group intakes across tertiles of fast food were determined using the general linear model with adjustments for age, sex, and energy intake as confounders. Mean CVD risk factors were compared across tertiles of fast food, using the general linear model with adjustments for age, sex, physical activity (MET-h/week), smoking (yes or no), BMI (except for WC), and dietary and energy intakes as confounders. To assess the overall trends of dietary and CVD risk factor adjusted-means across increasing tertiles of fast food consumption, the median fast food intake of each tertile was used as a continuous variable in the general linear model.[32] To determine the association of fast food consumption with CVD risk factors, multivariate linear regression models were used with adjustment for confounders in two models: model 1 adjusted for age, sex, BMI (except for WC), physical activity (MET-h/wk), and smoking (yes or no). Model 2 additionally adjusted for energy intake (kcal/d), dietary intake of fruit (g/d), vegetables (g/d), dairy products (ounce/d), legumes (g/d), and whole grains (g/d).

Results

In this study, 42% of participants were young adults and 58% were middle-aged adults. The mean consumption of fast food in young adults was 38.9 g/week (95% CI: 36.7–41.1) in tertile 1; in tertile 2 it was 111 g/week (95% CI: 108–114); and in tertile 3 it was 335 g/week (95% CI: 302–367). Among middle-aged adults

Table 1. General and clinical characteristics of young (19–30 years) and middle-aged adult (31–50 years) participants across fast food (g/1000 kcal/week) tertiles in Tehran Lipid and Glucose study.

	19–30 years				31–50 years			
	Tertile 1 (267)	Tertile 2 (267)	Tertile 3 (266)	*P* [1,2]	Tertile 1 (381)	Tertile 2 (381)	Tertile 3 (382)	*P* [1,2]
Fast food consumption	–	–	–	–	–	–	–	–
Range (g/1000 kcal/week)	< 31	31–71	> 71	–	< 22	22–49	> 49	–
Median (g/1000 kcal/week)	18.5	48.5	102.5	–	12.7	32.1	79.3	–
Age (years)	25.6 ± 3.1	24.4 ± 3.1	23.9 ± 3.2	< 0.01	41.0 ± 5.5	40.4 ± 5.6	39.7 ± 5.4	< 0.05
Weight (kg)[3]	66.8 ± 0.8	67.8 ± 0.8	69.4 ± 0.8	< 0.05	73.8 ± 0.7	75.4 ± 0.7	77.1 ± 0.7	< 0.01
Physical activity (Met-h/week)[3]	40.0 ± 3.8	32.9 ± 3.8	30.7 ± 3.8	NS	34.9 ± 2.8	39.4 ± 2.8	37.7 ± 2.8	NS
Current smoker (%)	6.7	6.7	13.9	< 0.01	10.7	15.3	17.8	< 0.05
Overweight (%)	28.1	28.8	29.4	NS	43.1	42.9	47	NS
Obesity (%)	10.9	9.7	11.3	NS	28.2	30.0	31.0	NS
Abdominal obesity (%)	12.7	18.0	20.7	< 0.05	37.9	43.4	44.4	NS
High triglycerides (%)	13.5	18.4	16.2	NS	34.2	34.7	42.3	< 0.05
High cholesterol (%)	15.7	12.0	13.9	NS	34.5	36.8	38.3	NS
Hypertension (%)	7.5	7.5	6.8	NS	16.7	17.9	14.2	NS

[1]Data are reported as mean or percentage unless otherwise noted. [2]*P* values were determined using the linear regression model across fast food tertiles for continuous variables (age, weight and physical activity) and chi-square test for categorical variables (current smoker, overweight, obesity, abdominal obesity, high triglycerides, high cholesterol and hypertension).[3]Adjusted for age and sex.

Table 2. Energy, nutrient and food group intake across fast food tertiles in young adults (19–30 years) and adults (31–50 years): Tehran Lipid and Glucose Study.[1]

	19–30 years				31–50 years			
	Tertile 1	Tertile 2	Tertile 3	*P*[2]	Tertile 1	Tertile 2	Tertile 3	*P*
Energy intake (kcal/d)	2175 ± 40	2364 ± 40	2675 ± 40	<0.01	2135 ± 33	2293 ± 33	2498 ± 33	<0.01
Energy density (kcal/100 g of total foods)	102 ± 1.5	105 ± 1.5	109 ± 1.5	<0.01	94 ± 1.1	95 ± 1.1	97 ± 1.1	NS
Protein (g/d)	78 ± 0.9	80 ± 0.9	85 ± 0.9	<0.01	78 ± 0.7	78 ± 0.7	79 ± 0.7	NS
Total fat (g/d)	76 ± 1.9	84 ± 1.9	99 ± 1.9	<0.01	71 ± 1.5	79 ± 1.5	91 ± 1.5	<0.01
Saturated fat (g/d)	26 ± 1.4	28 ± 1.4	36 ± 1.4	<0.01	24 ± 0.5	26 ± 0.5	30 ± 0.5	<0.01
Cholesterol (mg/d)	214 ± 9.2	228 ± 9.0	296 ± 9.2	<0.01	196 ± 5.6	226 ± 5.6	255 ± 5.6	<0.01
Total carbohydrate (g/d)	347 ± 2.9	342 ± 2.9	331 ± 2.9	<0.01	341 ± 2.1	335 ± 2.1	321 ± 2.1	<0.01
Total sugars (g/d)	139 ± 2.6	134 ± 2.5	132 ± 2.6	NS	136 ± 1.9	133 ± 1.9	130 ± 1.9	NS
Dietary fiber (g/d)	37 ± 0.9	37 ± 0.9	36 ± 0.9	NS	41 ± 0.8	39 ± 0.8	36 ± 0.8	<0.01
Vitamin C (mg/d)	141 ± 4.8	133 ± 4.7	138 ± 4.9	NS	154 ± 4.4	149 ± 4.3	141 ± 4.4	NS
Total carotenoids (mg/d)	9.8 ± 0.3	9.5 ± 0.3	9.2 ± 0.4	<0.01	9.8 ± 0.3	10.0 ± 0.3	10.0 ± 0.3	NS
Folate (mcg/d)	555 ± 7	553 ± 7	539 ± 7	NS	558 ± 6	556 ± 6	529 ± 6	<0.01
Calcium (mg/d)	1288 ± 26	1250 ± 25	1250 ± 26	NS	1323 ± 22	1263 ± 21	1199 ± 22	<0.01
Sodium (m/d)	4.3 ± 0.2	4.8 ± 0.2	5.2 ± 0.2	<0.05	4.2 ± 0.1	4.4 ± 0.1	4.8 ± 0.1	<0.05
Fruits (g/d)	350 ± 15.1	318 ± 14.5	313 ± 15.1	NS	375 ± 13.1	359 ± 12.9	331 ± 13.1	<0.05
Non-starchy vegetables (g/d)	281 ± 12.2	224 ± 11.7	240 ± 12.3	<0.05	268 ± 9.2	288 ± 9.2	282 ± 9.3	NS
Dairy (ounce/d)	16.2 ± 0.6	14.9 ± 0.6	14.4 ± 0.6	NS	15.4 ± 0.4	15.3 ± 0.4	14.6 ± 0.4	NS
Legumes (g/d)	15.2 ± 1.4	14.2 ± 1.4	17.5 ± 1.4	NS	17.4 ± 1.2	18.4 ± 1.2	16.9 ± 1.2	NS
Meat (g/d)	52 ±2.7	62 ± 2.6	71 ± 2.6	<0.01	53 ± 2.3	56 ± 2.3	66 ± 2.3	<0.01
Refined grains (g/d)	395 ± 11.7	384 ± 11.3	316 ± 11.8	<0.01	374 ± 9.0	356 ± 8.9	300 ± 9.1	<0.01
Whole grains (g/d)	92 ± 5.0	103 ± 4.8	108 ± 5.0	NS	98 ± 4.3	99 ± 4.3	100 ± 4.3	NS
Soft drinks (ounces/week)	7.4 ± 1.3	8.7 ± 1.3	12.7 ± 1.4	<0.05	4.8 ± 0.6	6.4 ± 0.6	8.9 ± 0.6	<0.01

[1]Data are reported as mean ± SEM; [2]*P* value determined by using linear regression models with adjustments for age, sex and energy intake.

the mean consumption was26.5 g/week (95% CI: 25.1–27.9) in tertile 1; 74.1 g/week (95% CI: 72.3–75.9) in tertile 2; and 225 g/week (95% CI: 211–239) in tertile 3. General and clinical characteristics of the study participants across fast food tertiles are presented in Table 1.

The prevalence of overweight was 28.8% in young adults, whereas 10.6% were obese. In middle-aged adults, 44.3% were overweight and 29.7% were obese. The prevalence of hypertriglyceridemia was 16% for young adults and 37.1% for middle-aged adults. Hypercholesterolemia was present in 13.8% of young adults and 35.2% of middle-aged adults; hypertension was prevalent in 7.3% of young adults and 16.1% middle-age adults. In both age groups, participants in the highest tertile of fast food consumption were significantly younger, and weighted more (young adults: 2.6 kg; middle-aged adults: 3.3 kg; $P < 0.05$) compared with participants in the lowest tertile. No significant difference in physical activity was observed across tertiles of fast food. The rate of smoking was significantly higher in subjects with higher fast food intakes ($P < 0.05$). The prevalence of abdominal obesity in young adults (12.7% in tertile 1 vs. 20.7% in tertile 3; $P < 0.05$) and the prevalence of hypertriglyceridemia in middle-aged adults increased significantly across tertiles of fast food consumption (34.2% in tertile 1 vs. 42.3% in tertile 3; $P < 0.05$).

Mean dietary intakes across categories of fast food consump-

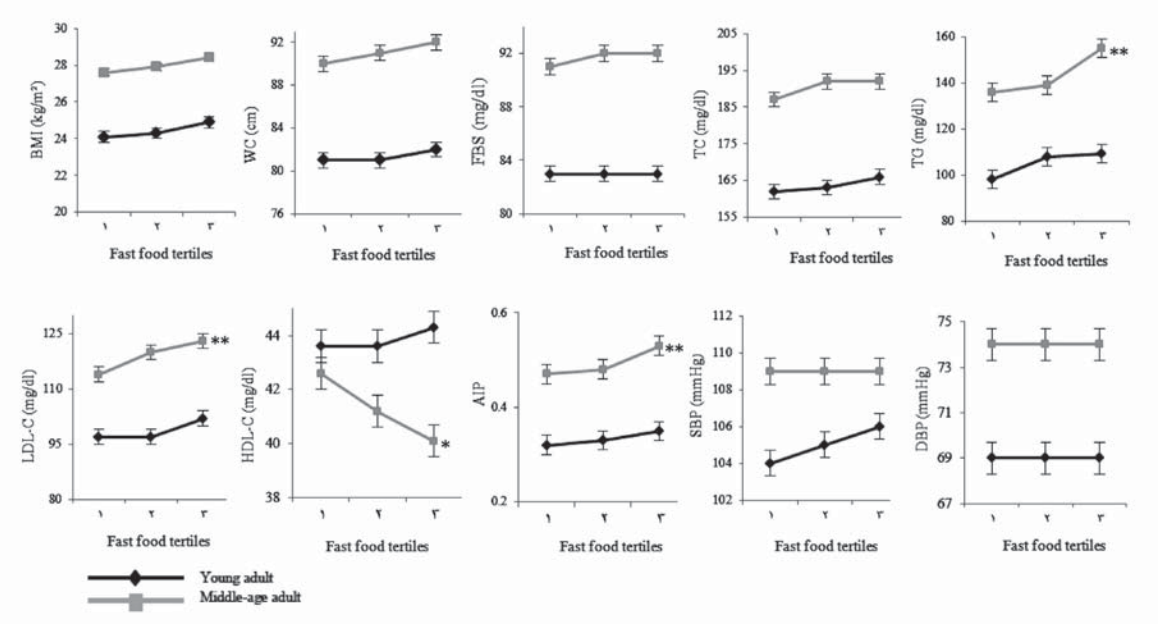

Figure 1. Mean cardiovascular disease (CVD) risk factors across tertiles of fast food consumption in young adults (19–30 years) and middle-aged adults (31–50 years). General linear model was used with adjustments for age, sex, physical activity, BMI [except for waist circumference], smoking status, energy, and dietary intake.

Table 3. Multivariate regression models to predict effects of fast food intake (g/1000 kcal/week) on cardiovascular risk factors in young (19–30 years) and middle-age adults (31–50 years) from Tehran Lipid and Glucose Study.[1]

	19–30 years		31–50 years	
	Model 1[2]	Model 2[3]	Model 1	Model 2
Body mass index (BMI)	0.076*	0.104**	0.045	0.051
Waist	0.070*	0.083**	0.034	0.029
Fasting serum glucose	0.014	0.016	0.017	0.010
Serum total cholesterol	0.045	0.046	0.003	0.001
Serum triglycerides	0.038	0.028	0.082**	0.072*
LDL-C	0.042	0.041	0.034	0.038
HDL-C	0.027	0.010	-0.063*	-0.051*
Atherogenic index of plasma	0.031	0.024	0.065*	0.056*
Systolic blood pressure	0.032	0.031	0.001	-0.011
Diastolic blood pressure	0.017	0.025	0.026	0.016

[1]Values are standardized coefficient (β) from linear regression models. [2] Model 1 adjusted for age, sex, smoking status, physical activity, and BMI [except for waist circumference]. [3] Model 2, adjusted for energy intake, dietary intake of fruits, vegetables, dairy products, legumes, whole and refined grains. * $P < 0.05$; ** $P < 0.01$

tion are shown in Table 2. Mean dietary intakes of energy, fat, saturated fat, cholesterol, sodium, meat, and soft drinks increased significantly($P < 0.05$), while carbohydrate and refined grain intakes decreased ($P < 0.01$) across tertiles of fast food in both age groups. In young adults, dietary energy density and protein intakes significantly increased ($P < 0.01$) and intakes of non-starchy vegetables and carotenoids decreased ($P < 0.05$). In middle-aged adults dietary intakes of fiber, folate calcium, and fruits decreased significantly ($P < 0.05$) across fast food tertiles.

There were no significant differences in total sugar, vitamin C, dairy, legumes and whole grains across fast food tertiles in both young and middle-aged adults. There were no significant differences in fast food consumption and dietary intakes across categories of fast food consumption between men and women.

Mean CVD risk factors across tertiles of fast food intake are presented in Figure 1. After adjustments for age, energy intake, physical activity, smoking status, and dietary and energy intake, there was a significant increase in serum triglycerides, LDL-cholesterol, and the atherogenic index of plasma and a significant decrease in HDL-C across fast food tertiles in middle-aged adults ($P < 0.05$). No significant trends in CVD risk factors across fast food tertiles were observed in young adults. There were no significant differences in means of CVD risk factors across categories of fast food consumption between men and women.

Multivariate regression analysis was used to predict effects of fast food consumption on CVD risk factors (Table 3). After adjustment for potential confounders in model 2, BMI (β = 0.104, $P < 0.01$), and WC (β = 0.083, $P < 0.01$) in young adults, and serum triglycerides (β = 0.072, $P < 0.05$), HDL-C (β = -0.051, $P < 0.05$), and atherogenic plasma index (β = 0.056, $P < 0.05$) in middle-aged adults were associated with fast food intake.

Discussion

In this study, fast food consumption significantly affected the dietary intakes of participants. These findings were consistent with results of other studies which indicated that fast food consumption was associated with poor diet quality.[33,34] Previous studies have shown fast food consumption to be associated with higher intakes of fat (saturated and trans), cholesterol and sodium, and

lower intakes of vitamin A, carotenes, vitamin C, calcium and magnesium.[35,36] Decrease in dietary intakes of whole grains, legumes, dairy, fruits and vegetables as main sources of essential nutrients and health promotion compounds, is one of undesirable consequences of increased fast food consumption.[37]

In this study anthropometric measures in young adults, and serum triglycerides, HDL-C and the atherogenic index of plasma in middle-aged adults were associated with fast food consumption. Kelishadi et al.[14,17] in the Heart Health Promotion from Childhood study, as part of a community-based intervention program called the Isfahan Healthy Heart Program, have shown that the frequency of fast food consumption has a positive correlation with BMI, total cholesterol, LDL-C and triglycerides, and a negative correlation with HDL-C in adolescents. Doost Mohammadian et al.[15] have reported that the frequency of fast food consumption is positively associated with BMI in adolescent girls in Semnan, which contradicts the findings of Tabatabaee et al.[16] who have shown no association between the frequency of fast food consumption and BMI. However, in both studies, the amounts of fast food consumption by adolescents, its effect on diet quality, and CVD risk factors have not been assessed.

Previous studies have reported an association between fast food consumption, overweight and obesity.[38–40] Frequent consumers of fast foods had higher weights, insulin resistance, WC, triglycerides, and lower HDL-C after longitudinal follow-up.[1,10]

Consumption of fast food seems to be a cause of obesity and other CVD risk factors through several mechanisms[33]; fast food is high in energy density, fat and saturated fat, glycemic load and glycemic index. High fat content and energy density of fast food (158 to 163 kcal/100 g)[41] upset the regulation of appetite and energy intake,[42] and promote adiposity, dyslipidemia and metabolic syndrome.[38,43–46] High contents of saturated and trans fatty acids (up to 24 g/serving) are potent health-threatening fats in fast foods and have been found to increase LDL-C and triglycerides, decrease HDL-C, and accelerate the development of CVD.[47–49] The high glycemic index of fast foods may contribute to an increase in energy intake, and induce lipogenesis and beta-cell dysfunction. Therefore it is considered a risk for obesity and metabolic disorders.[38,50]

One limitation of this study was the use of a fast food questionnaire for collecting dietary data. In addition, this was a cross-sectional study which limited our ability to determine causality between fast food consumption and CVD risk factors.

To our knowledge, this is the first study conducted on a large population to investigate the status of fast food consumption in young and middle-aged Iranian adults and its impact on dietary intakes and CVD risk factors.

In conclusion, higher intakes of fast foods were significantly associated with higher energy intake, fat, saturated fat, cholesterol, sodium, and soft drinks, and lower intakes of fruit, vegetables, fiber, carotenoids and calcium. Fast food consumption was positively associated with anthropometric measures in young adults and with lipid profile abnormalities in middle-aged adults.

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