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Original article

Nutrient intake and unhealthy dietary pattern of Iranian women: a cross sectional study

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Summary. *Objective:* The present study aimed to assess dietary pattern and nutrient intake of women to determine whether the nutrient intakes meet the Dietary Reference Intakes (DRIs). *Methods*: This cross-sectional dietary assessment survey was conducted between May and June 2014 in Hamadan city, the west of Iran. A random representative sample of 823 women aged 23-49 years participated in this study. The data collection tool was validated Iranian 168-item semi-quantitative food-frequency questionnaire (FFQ). Participants were classified based on energy intake, into low, normal and high energy groups (<1800, 1800 – 2200 and ≥2200 kcal/day, respectively). *Results*: Fat-soluble vitamins and potassium intake in all the three energy groups, iron intake in low and normal, and calcium intake in low energy group was significantly less than the DRIs. Intake of sodium, solid fat, added sugars, junk foods and refined grains was significantly more than upper recommended limit in the three energy groups. Educational level, job and income were strongly related to intake of food groups. *Conclusion*: The result of this dietary assessment will provide the basis for policy making and interventions that are appropriately tailored to each subgroups considering daily energy intake and socioeconomic status in improving their dietary behaviors.

Key words: food frequency questionnaire (FFQ), energy intake, dietary intake, dietary habits, women's health, food security

Abbreviations

FFQ: Food frequency questionnaire
DRI: Dietary reference intake
LEI: Low energy intake
NEI: Normal energy intake
HEI: High energy intake
NCDs: Noncommunicable diseases
HESMF: Healthy eating for student, mother and family
FCT: Food composition table
USDA: US Department of Agriculture

Introduction

Noncommunicable diseases (NCDs) are responsible for 36 million deaths annually worldwide and of this, nearly 80% (29 million) occur in low-and middle-income countries (1). NCDs would be the most common cause of death in 2030 (1). Furthermore, more than 9 million deaths attributed to NCDs occur in people under 60 years old, and 90% of these premature deaths occur in low and middle-income countries (1). In the preventing of non-communicable diseases, such as cardiovascular disease (2, 3), diabetes (4, 5) and cancer (6-9).

Healthy dietary pattern is one of the most important factors (10). The nutrition transition is occurring rapidly in developing countries (11). In these regions, most of people consume low nutritious and energy-dense foods that lead to obesity (12, 13) and diet-related morbidity (14, 15).

With dietary assessment we can determine the unhealthy food habits and it will help us in planning nutritional interventions to modify unhealthy food patterns (13, 16).

Parents play an important role in shaping children's dietary habits (17). Mothers have key role on food choices and dietary habits in family and nutritional habits of mothers directly affect the food habits and dietary intake of family (18). There is an emotional interaction between mothers and their children in food choices and nutritional habits (19). Attachment Theory can be described as an emotional tone between children and their caregivers (mother) (20). Bonding is related to the mother's feelings for her child (20). According to Attachment Theory and bonding, a positive emotional relationship is formed between mother and her child, which usually continues until early adolescence (20). Based on this interaction between mother and child and considering that determining and modifying the mother's nutritional problems and priorities will affect family nutritional habits, we selected mothers as our target group and children as interface between school and home.

A study that examined the nutritional status of women in Hamadan just focused on consumption of some food groups like fruits and vegetables. In this study other food groups of food pyramid, dietary habits and intake of unhealthy foods in women in Hamadan were not examined (21). In this study, our purpose was to determine women's dietary pattern and nutrients intake considering energy based classification in Hamadan.

Materials and Methods

This study was approved by the Ethic Committee (P/16/30/9/715) and Research Council of Hamadan University of Medical Sciences. All participants of the study enrolled voluntarily and anonymously.

Participants

This cross-sectional study was conducted, between May and Jun 2014, among a random sample of 23-49 years old mothers who had at least one elementary school student, in Hamadan city, the west of Iran. Because mothers play a key role in cooking, food choice and family dietary habits, we assessed the nutritional status of mothers as a representative of their family. Pregnant and lactating women, over and under reporters, and women with special diets were excluded from the analysis.

Sampling method

To ensure that representative samples of women were obtained we used stratified cluster random sampling method, Figure 1. We considered each region of the city as a stratum (1st stratification level). Due to gender separation of schools in Iran, we divided elementary schools into two subgroups based on student gender Including girls and boys (2nd stratification level) within each region. Then, according to random numbers table, five elementary schools were randomly selected from each subgroup (1st clustering level). We selected two classes in each school randomly (2st clustering level). Mothers of all students of each class were included in the study (3rd stratification level) excluding pregnant and lactating women and individuals with special diets like diabetic people. According to World Health Organization Guideline one of the previous studies reported the prevalence of fruits and vegetables consumption among adults 25.1% (21). Assuming that a prevalence of 0.251, we obtained a sample of 510 at 0.05 significance level. Because of cluster random sampling, we increased the sample size 1.5 fold to 765 individuals. In the first part of the questionnaire, we declared that those who are not willing to participate in the study can refuse. Considering the probability of reduced sample size due to exclusion criteria or refusal, we increased the sample size by 40% to the size of 1084.

Data collection tool

The data collection tool was a self-administered 168-item semi-quantitative food-frequency questionnaire (FFQ) that its validity and reliability have already

been evaluated and approved for Iranian population (22, 23). The subjects were asked to report the frequency of their consumption for each food item during the last year on a daily, weekly, or monthly basis according to portion sizes. Portion size of each FFQ item was determined based on the USDA portion size (e.g. bread, one slice; dairy, one cup, orange one medium) and, for some items, household measures (e.g. chicken meat, one breast, leg or wing; rice, one large, medium or small plate) according to Hosseini Esfahani's

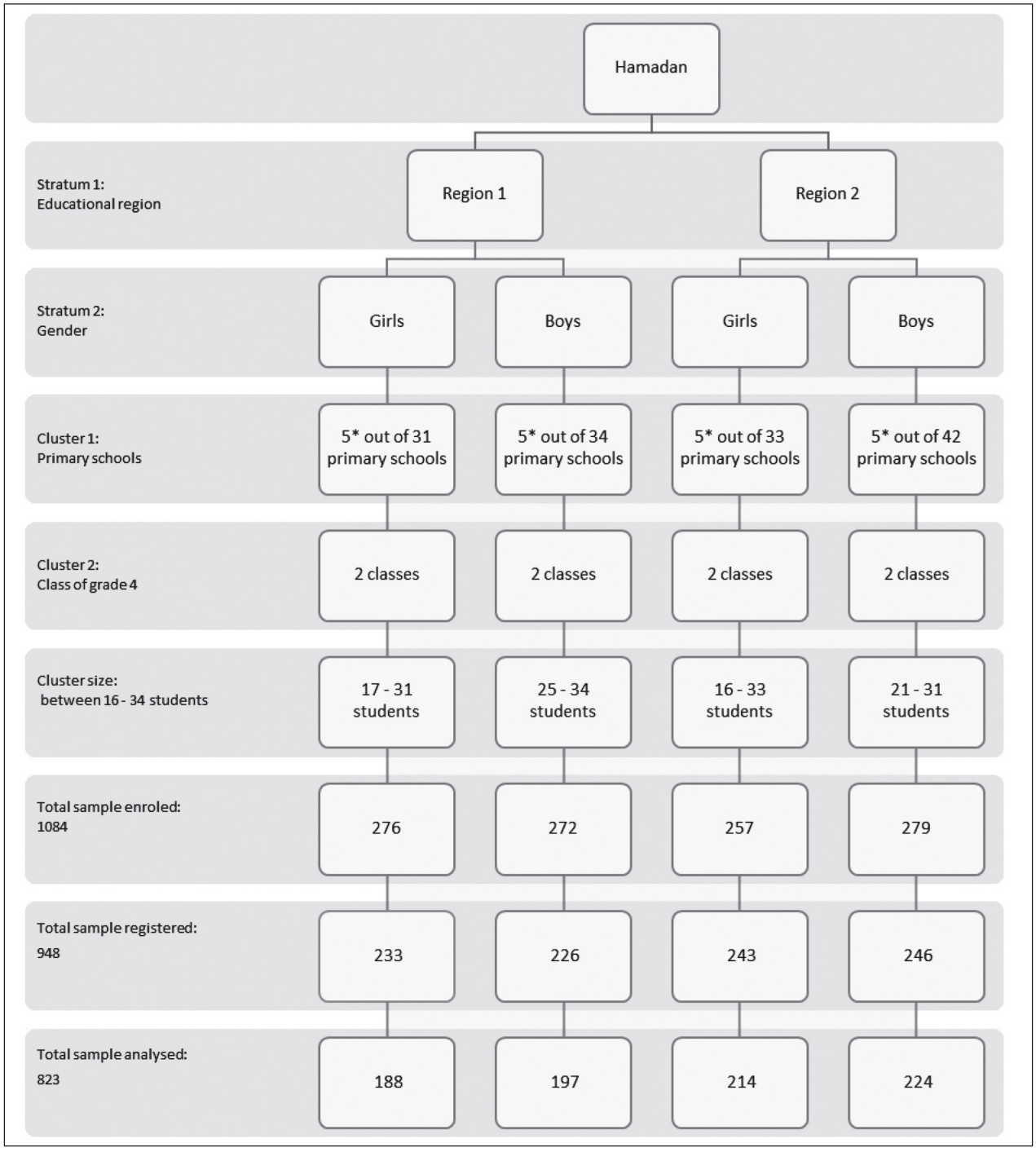

Figure 1. Method of stratified cluster random sampling.

study (22) with brief modifications. According to the objectives of this study about assessment of unhealthy dietary intake we considered added sugars, solid fats, salty snacks, junk foods and fast foods in separate food groups. Because the Iranian food-composition table (FCT) (24) is incomplete, all foods and beverages were analyzed regarding energy and nutrient consumption with the US Department of Agriculture's (USDA) FCT. Then, according to household measures, the frequency of each food item was converted to grams for daily consumption.

Assessment of dietary intake

In a pilot study carried out on 48 subjects, the initial questionnaire was evaluated and revised for some required items. This survey is the first step of Healthy eating for Student, mother and family Project (HES-MF) that is an interventional program to modify unhealthy nutritional habits of families in Hamadan city. To modify the unhealthy eating habits of mothers and children in nutritional interventions also to send educational messages for mothers and to data collection in this survey, we considered the students as the interface between school and home. The students were trained in the 20-minute session about food group serving sizes and method of filling out the questionnaire. We collected data from student to compare it with Mothers' data as well as to ensure that students have trained their mothers how to complete the questionnaire. Then, under full supervision of one of the researchers, the students filled out the short form questionnaire that was the same as their mothers. Mothers' questionnaires delivered to their houses and the trained students were responsible to help their mothers to filling out the questionnaires. To return the mothers' questionnaires, teacher and school health educator reminded the students several times. To improve the response rate, students were encouraged to give them a gift at the time of returning their mothers' questionnaires. To prevent seasonal influence on dietary intakes, data collection was performed during a month. Also to avoid interviewer bias, training of students was conducted by one researcher for all. To avoid the information bias and In order to preserve the respondents' identity, questionnaires were anonymous and to identify each questionnaire, we considered a separate code. According to the Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (25) and 2010 Dietary Guidelines for Americans (26), estimated energy requirement for 31-50 years old women is 1800–2200 kcal. Therefore, we divided women to three energy groups: (a) low energy group (LEG) who received less than1800 kcal/day; (b) normal energy group (NEG) who received 1800–2200 kcal/day; and (c) high energy group (HEG) who received equal to or more than 2200 kcal/day (Tables 2 and 3). Based on national survey about food insecurity in Iran (27) and a study about nutrition transition in Iran (28), we classified the subjects by percentage of their intake from RDI recommendations (<80% RDI), (80-90% RDI), (90-110% RDI), and (>120% RDI) (Table 3).

Statistical analysis

Descriptive statistics were expressed as percentage, mean values and standard deviations (mean ±SD). Comparison between mean values of nutrients and DRI values was made using the independent t-test. The comparison of mean intakes of food groups considering various socioeconomic characteristics were tested using analyses of variance ANOVA. Stata version 11 (StataCorp, College Station,TX, USA) was used for data analysis with 95% confidence interval (CI).

Results

Sample characteristics

A total of 1084 participants were confirmed eligible for the study. Among these, 947 women participated voluntarily in this study. Accordingly, the response rate was about 87%. Four pregnant, two lactating women and six individuals on special diets like diabetic people were excluded. To check the accuracy of the responses, we used some checking questions. Furthermore, returned questionnaires were reviewed and 106 questionnaires were excluded due to the low accuracy in answering questions, i.e. they had over than 5% missing data. Based on the

estimated energy requirement, the reported daily energy intake was divided into <1800, 1800–2200 and ≥2200 kcal/day According Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (25) Those who did not qualify for (mean ±2 SD) range were considered incorrect reports of daily energy intake (under or over reporting) (29) Six subjects were excluded for this reason. Finally, 823 questionnaires were analyzed. No significant differences were found between individuals excluded and those included in the final analysis in regard of demographic variables. Considering the groups divided based on daily energy intake, 29.76%, 24.54%, and 45.68% of participants were in low, normal, and high energy intake groups, respectively.

Table 1 describes the demographic characteristics of the women. There was the same pattern of educational level, job and income among the three energy groups. Less than one third of subjects were primary and secondary school level, about one third were in high school and about one third had academic degree. About one fourth of women were working out of home, three forth of the subjects were housewife, and 5% where educating and retired. About 85% of subjects were reported with monthly family income less than 600 US$s.

Intake of 15 food groups

Table 2 reports the mean (SD), energy (kcal) and daily intakes for 15 food groups, which was based on three categories of energy intake: low, normal and high energy intake. Intake of added sugars in the three energy groups was more than upper limit in 2015-2020 Dietary Guideline for Americans (30) (p = 0.001). Daily energy intake from refined grains was three times more than whole grains in all the groups. Junk food consumption in HEG was twice compared the other two groups. We found the same dietary pattern in the three energy groups in terms of total daily energy intake from each the 15 food groups including: refined grains, whole grains, added sugars, dairy products, vegetables and legumes.

Nutrient intake

Table 3 demonstrates the mean intake and distribution of women by percentage of their intake from RDI recommendations for selected nutrients in three categories of energy intake. In general, average energy and nutrient intake in HEG was significantly higher than the two other groups (p = 0.001). Intake of fat-soluble vitamins (A, E, K and D) and potassium in LEG, NEG and HEG was less than 80% of RDI recommendations (p = 0.001). Iron intake in LEG and

Table 1. Demographic variables of women by three energy classification.

	Distribution within energy groups		
Characteristics of women	<1800 kcal/d	1800-2200 kcal/d	>2200 kcal/d
Age/years Mean (SD)	36.23 (4.89)	37.14 (4.78)	36.51 (5.03)
Educational Level N (%)			
Primary school	43 (17.7)	26 (13.0)	50 (13.3)
Secondary school	31 (12.7)	36 (18.0)	60 (16.0)
High school	73 (30.0)	70 (35.1)	128 (34.1)
Academic	96 (39.5)	67 (33.6)	137 (36.5)
Job N (%)			
Working	54 (22.1)	51 (25.2)	95 (25.3)
House wife	190 (77.8)	151 (74.7)	280 (74.6)
M/Income N (%)			
≤149$	50 (21.3)	32 (16.4)	56 (15.8)
150-299$	81 (34.6)	84 (43.3)	137 (38.7)
300-599$	70 (29.9)	56 (28.8)	104 (29.3)
600-899$	26 (11.1)	16 (8.2)	41 (11.5)
≥900$	7 (2.9)	6 (3.0)	16 (4.5)

Table 2. Energy, percent of total energy and mean intake in each 15 food groups

Energy groups	**LEI**			**NEI**			**HEI**			**Total**		
N (%)	245 (29.77)			202 (24.54)			376 (45.69)			823 (100)		
mean (SD) of Energy	1465 (245)			2007 (114)			2768 (497)					
	Energy (Kcal)	%TE	Mean (g/d) ±SD	Energy (Kcal)	%TE	Mean (g/d) ±SD	Energy (Kcal)	%TE	Mean (g/d) ±SD	Energy (Kcal)	%TE	Mean (g/d) ±SD
Whole Grains	152.52	10.41	67.41±58.21	226.40	11.28	98.48±72.42	313.09	11.31	137.04±107.14	238.86±27.94	10.93	106.85±91.77
Refined Grains	438.63	29.93	274.46±102.85	576.64	28.72	356.96±137.28	759.93	27.45	480.54±234.51	622.26±31.58	28.55	388.86±202.07
Potatoes	19.80	1.35	20.63±18.66	26.37	1.31	27.56±24.63	28.52	1.03	29.72±28.22	25.66±1.82	1.18	26.49±25.11
Dairy Products	132.59	9.05	157.42±89.97	174.94	8.71	210.42±105.76	226.88	8.20	268.15±131.46	181.92±28.68	8.32	221.02±123.58
Vegetables	117.64	8.03	156.95±78.35	151.78	7.56	196.54±86.09	199.74	7.21	245.02±107.30	159.98±15.20	7.32	206.90±101.59
Fruits	70.69	4.82	106.69±74.36	95.88	4.78	146.93±85.79	141.71	5.12	207.06±127.85	106.24±30.02	4.84	162.43±113.11
Legumes	103.62	7.07	61.41±35.75	136.65	6.81	78.38±38.18	173.56	6.27	99.64±55.35	149.71±32.18	6.89	83.04±49.03
Meats	59.80	4.08	30.93±13.85	78.28	3.90	39.66±16.09	97.23	3.51	48.85±19.79	79.52±11.00	3.64	41.26±18.91
Nuts & Seeds	11.04	0.75	2.16±3.11	14.58	0.73	2.90±3.76	22.79	0.82	4.53±4.81	16.06±4.73	0.73	3.43±4.24
Solid Fats	46.08	3.14	6.96±7.19	83.41	4.15	12.25±13.09	123.01	4.44	18.46±15.59	91.68±8.07	4.21	13.46±13.84
Liquid Oils	73.39	5.01	1.66±0.63	84.15	4.19	1.91±0.84	86.83	3.14	1.97±0.96	80.80±7.01	3.70	1.86±0.85
Salty Snack	44.44	3.03	19.23±27.76	63.33	3.15	28.14±38.27	103.28	3.73	47.25±47.18	78.04±15.48	3.59	34.22±41.90
Added Sugars	154.54	10.55	78.34±74.27	221.23	11.01	118.42±118.81	349.07	12.61	193.44±185.23	255.01±28.01	11.67	140.76±153.02
Junk foods	26.06	1.78	4.79±6.36	55.54	2.77	10.24±16.05	115.30	4.16	21.29±28.91	76.19±12.34	3.50	13.67±22.56
Fast Foods	17.66	1.21	6.46±8.83	27.16	1.35	9.67±9.70	36.38	1.31	13.20±12.33	27.88±3.58	1.28	10.33±11.13

Abbreviations: TE (total energy), SD (standard deviation), LEI (low energy intake, daily energy intake < 1800 Kcal), NEI (normal energy intake, daily energy intake 1800 – 2200 Kcal), HEI (high energy intake, daily energy intake > 2200 Kcal).

Table 3. Mean (SD) of nutrient intakes and Consumption Level in women according to RDI recommendations (by energy groups)

Categories	DRI	LEI, N=245 mean (SD) of Energy: 1465 (245)						NEI, N= 202 mean (SD) of Energy: 2007 (114)						HEI, N=376 mean (SD) of Energy: 2768 (497)					
Nutrients	Ref.	<80% DRI	80-90% DRI	90-110% DRI	>110% DRI	Mean (SD)	P value	<80% DRI	80-90% DRI	90-110% DRI	>110% DRI	Mean (SD)	P value	<80% DRI	80-90% DRI	90-110% DRI	>110% DRI	Mean (SD)	P value
Protein (g/day)	46	13.06	17.14	35.92	33.88	47.0 (10.3)	0.132	0.00	1.98	7.92	90.10	63.1 (10.1)	<0.001	0.00	0.00	0.53	99.47	83.9 (17.3)	<0.001
Sodium (mg/day)	1500	3.27	0.41	3.67	92.65	2959.4(1184.1)	<0.001	0.50	0.50	0.00	99.01	3910.1(1100.3)	<0.001	0.00	0.00	0.00	100.00	4740.2(1266.2)	<0.001
Potassium (mg/day)	4700	55.52	10.73	17.35	16.40	2612.5(880.9)	<0.001	62.85	9.29	17.03	10.84	3416.8(1139.6)	<0.001	61.75	13.66	13.11	11.48	4609.1(1507.8)	0.243
Phosphorus (mg/day)	700	5.71	4.08	26.12	64.08	863.3 (199.0)	<0.001	0.00	0.50	1.98	97.52	1175.6 (211.8)	<0.001	0.00	0.00	0.00	100.00	1570.8 (345.8)	<0.001
Calcium (mg/day)	1000	59.59	11.43	14.69	14.29	820.3(329.5)	<0.001	19.80	11.88	33.17	35.15	1068.1(402.4)	0.017	5.85	6.12	16.76	71.28	1401.2(508.4)	<0.001
Iron (mg/day)	18	93.06	4.49	2.04	0.41	10.8 (2.6)	<0.001	43.56	32.18	20.79	3.47	14.9 (2.3)	<0.001	6.65	15.69	31.38	46.28	19.9 (4.6)	<0.001
Magnesium (mg/day)	320	50.61	16.73	18.78	13.88	269.1 (74.4)	<0.001	7.43	8.91	38.61	45.05	359.2 (90.1)	<0.001	0.27	1.33	11.17	87.23	483.3 (135.0)	<0.001
Manganese (mg/day)	1.8	32.20	11.80	33.10	22.80	1.7 (0.64)	0.010	6.90	11.30	26.20	55.40	2.2 (0.8)	<0.001	3.10	2.10	10.30	84.30	2.9(1.1)	<0.001
Selenium (µg/day)	55	19.10	13.06	30.20	37.50	56.05 (15.6)	0.290	5.90	4.90	14.30	74.70	73.7 (20.0)	<0.001	0.05	0.05	5.05	93.80	97.03 (29.8)	<0.001
Zinc (mg/day)	8	43.67	13.88	29.39	13.06	6.9 (1.7)	<0.001	4.46	6.93	26.73	61.88	9.3 (1.8)	<0.001	0.00	1.33	5.05	93.62	12.4 (3.0)	<0.001
Vitamin A (µg/day)	700	68.77	7.89	8.52	14.83	332.8 (177.4)	<0.001	72.45	8.05	9.29	10.22	457.7 (311.7)	<0.001	77.60	6.56	7.65	8.20	569 (268.6)	<0.001
Vitamin K (µg/day)	90	95.10	1.22	2.86	0.82	38.13 (19)	<0.001	82.67	4.46	8.91	3.96	53.22 (23.6)	<0.001	55.59	9.84	14.36	20.21	74.42 (33.2)	<0.001
Vitamin D (µg/day)	5	100.00	0.00	0.00	0.00	0.89 (0.6)	<0.001	99.50	0.00	0.50	0.00	1.23 (0.7)	<0.001	97.87	0.80	0.53	0.80	1.58 (1.0)	<0.001
Vitamin E (mg/day)	15	64.98	16.09	13.56	5.36	8.5 (2.1)	<0.001	61.92	15.17	13.62	9.29	11 (3.0)	<0.001	68.85	8.74	10.38	12.02	13.3 (4.1)	<0.001
Vitamin C (mg/day)	75	50.20	7.76	13.47	28.57	71.3 (39.9)	0.147	18.32	15.35	10.40	55.94	95.2 (44.8)	<0.001	6.65	7.71	6.91	78.72	133 (62.9)	<0.001
Thiamin (mg/day)	1.1	7.35	2.86	17.55	72.24	1.3 (0.3)	<0.001	0.50	0.00	0.99	98.51	1.8 (0.3)	<0.001	0.00	0.00	0.00	100.00	2.4 (0.6)	<0.001
Riboflavin (mg/day)	1.1	13.88	9.39	26.53	50.20	1.2 (0.3)	<0.001	1.98	0.99	8.42	88.61	1.6 (0.4)	<0.001	0.00	0.00	3.46	96.54	2.1 (0.5)	<0.001
Niacin (mg/day)	14	6.31	6.62	12.30	74.76	13.5 (3.1)	0.012	5.88	5.57	13.31	75.23	18.3 (3.2)	<0.001	8.20	6.01	17.49	68.31	24.6 (5.8)	<0.001
Vitamin B6(mg/day)	1.3	12.30	4.42	16.72	66.56	1.1 (0.2)	<0.001	15.48	4.95	19.81	59.75	1.4 (0.3)	<0.001	21.31	8.74	21.31	48.63	2.03 (0.5)	<0.001
Folate (total) (Mg)	400	3.15	2.21	11.36	83.28	452.2 (99.6)	<0.001	1.86	1.55	11.46	85.14	596 (101.1)	<0.001	3.28	2.19	12.57	81.97	786.1(180.9)	<0.001
Vitamin B12 (µg/day)	2.4	45.45	0.00	22.73	31.82	2.23 (1.2)	<0.001	23.29	1.37	39.73	35.62	2.69 (1.1)	<0.001	4.40	0.41	8.25	86.93	5.28 (2.8)	<0.001
Biotin (µg/day)	30	89.39	5.31	4.49	0.82	16.9 (5.6)	<0.001	53.47	15.35	21.29	9.90	23.7 (6.9)	<0.001	22.07	13.30	23.40	41.22	32.3 (11.1)	<0.001
Pantothenic (mg/day)	5	92.24	6.12	1.63	26.50	3 (0.7)	<0.001	45.05	25.25	27.72	1.98	4 (0.7)	<0.001	10.90	14.89	34.04	40.16	5.4 (1.4)	<0.001

Abbreviations: g (grams), mg (milligrams), µg (micrograms), DRI (dietary reference intake), SD (standard deviation), LEI (low energy intake, daily energy intake < 1800 Kcal), NEI (normal energy intake, daily energy intake 1800 – 2200 Kcal), HEI (high energy intake, daily energy intake > 2200

NEG was significantly less than DRI recommendations (p = 0.001). Most participants in LEG consumed calcium less than 80% of DRI recommendation (p = 0.001). In addition, Potassium intake of a majority of the participants in HEG and NEG was less than 80% of DRI recommendations than LEG (p = 0.001). Our data demonstrate that Sodium, protein, thiamin, riboflavin, biotin and vitamin B6 consumption of most women in the three energy groups was more than DRI recommendation

Comparison of food groups considering demographic variables

Table 4 demonstrates the comparison of mean of energy and 15 food groups considering educational level, job and income. There was a significant relationship between educational level and refined grains, potatoes, dairy products, vegetables, fruits, legumes, meats, nuts and seeds, solid fats, liquid oils, salty snacks, added sugars, fast foods. We found significant relationship between job and dairy products, fruits, legumes, meats, nuts and seeds, salty snacks, added sugars, fast foods. This study demonstrated that there were significant relationship between family income and energy, refined grains, dairy products, vegetables, fruits, legumes, meats, nuts and seeds, solid fats, liquid oils, salty snacks, added sugars, fast foods

Discussion

This study aimed at determining women`s unhealthy dietary habits and assessing the nutrient intakes, considering energy classification. Based on the result of this dietary assessment we have determined unhealthy dietary habits and nutrient deficiencies in women.

Due to the importance of daily energy intake, nutritional analysis was performed according to the distribution of women by daily energy intake in HEI, NEI and LEI groups. About half of the subjects were in the HEI group. High calorie intake leads to overweight and obesity (31) which are risk factors for chronic diseases (32, 33). Mean intake of 15 food groups in HEG significantly was higher than two other groups. Total daily energy intake in all of the three energy groups followed the same sequence for refined grains, whole grains, added sugars, dairy products, vegetables and legumes. It showed the same dietary pattern for these food groups in the three energy groups, which means that the amount of energy intake did not affect the priority of these food groups in women's diet. It represents a common dietary pattern in our subjects considering daily energy intake. Kafeshani found that regardless of daily energy intake there were four major dietary patterns in Iranian adolescents (34).

Our results suggest that added sugar consumption in our subjects was more than the upper limit and in HEI group it was more than two other groups. According to 2015-2020 Dietary Guidelines for Americans (30) intake of added sugars should be limited to 10% of daily total calorie intake. The Iranian food-composition table (FCT) (24) is incomplete and there is not any comment about intake of added sugars. However, recommendation on reducing the consumption of added sugars is universal. In our study average consumption of added sugars was 11.67% of total energy intake and this is 16% in U.S. adolescents (35) and 13% in Canadians (36). In present study mean intake of added sugars was 140.76 gr/d and Zhang reported mean usual intake of added sugars 73-100 g/day among US adolescents (35). Our results suggest that from total daily energy intake, 349.07 kcal in HEG, 221.23 kcal in NEG, and 154.54 kcal in LEG comes from added sugars. Brisbois reported that estimated average energy available from total added sugars in Canadians was 456 kcal (36). 2015-2020 Dietary Guideline for Americans (30) and RDI (25) , recommend that less than 10% of daily energy intake have to be from added sugars. But percentage of added sugars from daily total calorie intake cannot exactly reflect the excess intake. Because, total of energy intake differs in various groups and persons. For example, in our study mean daily intake of added sugars was 193.44 gr in HEG, 118.42 gr in NEG, and 78.34 gr in LEG. Daily intake of added sugars in HEG is more than two other groups but percentage of daily intake of added sugars from total daily energy intake was almost at the same level in three energy groups.

In the present study, junk food consumption in HEG was 1.5 times more than NEG and 2.3 times more than LEG. daily energy intake from junk foods

Table4. Comparison of daily intake of energy and 15 food groups by educational level, job and income.

Food groups	Energy	Whole grains	Refined grains	Potatoes	Dairy products	Vegetables	Fruits	Legumes	Meats	Nuts & seeds	Solid fats	Liquid oils	Salty snack	Added sugars	Junk foods	Fast foods
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Educational Leve																
Primary school	2077.66	104.65	346.55	27.42	182.38	170.41	113.45	97.17	35.14	2.79	12.96	1.59	43.98	115.00	14.65	8.89
	598.58	81.90	156.07	23.49	102.18	86.34	89.15	62.18	18.66	4.05	13.29	0.75	45.79	110.40	24.95	11.56
Secondary school	2220.90	98.69	422.71	33.18	189.19	193.02	140.26	89.69	37.29	2.80	13.65	1.70	43.25	133.04	14.59	8.63
	585.21	72.10	195.65	26.00	101.16	94.30	111.49	47.57	15.35	4.09	12.55	0.60	49.64	125.17	22.86	8.76
High school	2231.10	105.58	402.42	26.00	218.23	211.20	161.97	84.87	40.69	2.95	15.59	1.98	33.71	135.26	14.57	9.94
	665.13	93.02	211.97	29.21	122.05	95.84	103.60	46.26	17.22	3.62	15.24	1.07	40.42	116.91	23.25	10.86
Academic	2202.80	113.38	377.17	23.98	252.92	224.98	191.73	73.69	45.76	4.38	11.85	1.90	27.29	159.75	12.31	11.78
	735.99	101.59	208.18	20.68	133.55	110.79	122.43	44.39	20.50	4.74	13.11	0.70	36.80	142.90	20.93	11.71
p value	0.201	0.454	0.011	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.006	0.587	0.014
Job																
Working	2241.41	109.59	393.40	26.20	237.39	212.39	195.01	70.86	45.60	4.33	13.79	1.89	27.96	160.06	15.19	11.75
	744.41	96.04	218.79	23.32	129.99	92.42	128.84	37.95	20.29	4.92	15.56	0.78	35.05	140.30	27.06	11.45
Hose wife	2180.49	106.05	387.76	26.59	215.76	205.33	151.81	87.14	39.85	3.13	13.37	1.85	36.23	134.72	13.21	9.85
	646.16	90.45	196.68	25.69	121.20	104.44	105.69	51.46	18.16	3.96	13.25	0.87	43.77	123.28	20.93	10.98
p value	0.264	0.635	0.732	0.849	0.031	0.393	0.000	0.000	0.000	0.000	0.712	0.486	0.015	0.014	0.281	0.035
Income																
≤149$	2110.97	99.07	369.62	27.22	170.03	171.15	108.38	90.90	34.88	2.81	16.44	1.60	45.74	125.84	14.45	9.10
	678.72	78.44	172.67	21.58	99.72	87.79	86.96	53.32	18.57	4.50	17.53	0.70	52.44	119.31	23.85	11.90
150-299$	2208.12	102.60	407.13	28.17	210.98	212.42	159.70	89.06	39.83	2.99	13.42	1.88	38.12	129.01	13.32	9.65
	638.56	88.64	207.84	28.13	113.19	97.93	109.46	50.63	17.15	3.96	13.46	0.85	45.38	113.97	20.79	10.66
300-599$	2165.26	105.43	361.69	25.84	242.62	215.10	174.51	78.00	43.82	3.78	12.79	1.95	27.93	150.30	14.67	10.16
	653.14	96.90	156.95	24.34	129.15	103.58	105.62	49.82	18.84	4.08	12.40	1.00	37.04	138.46	26.32	10.84
600-899$	2194.69	127.07	373.23	23.07	251.93	203.29	199.93	67.84	43.94	3.78	12.85	1.89	22.58	161.54	9.78	12.44
	604.07	102.13	191.89	23.04	120.83	93.84	129.74	32.63	20.30	3.35	13.09	0.60	22.49	136.07	14.76	12.14
≥900$	2549.37	128.04	450.60	17.37	325.98	267.27	237.99	71.49	55.35	6.94	9.73	1.92	35.63	208.79	11.24	15.07
	1084.03	122.58	309.26	15.48	182.74	140.54	162.22	36.00	25.28	6.63	14.12	0.80	27.98	174.16	16.1	11.90
p value	0.028	0.129	0.017	0.137	0.001	0.001	0.001	0.000	0.000	0.000	0.068	0.004	0.000	0.002	0.484	0.027

Abbreviations: SD (standard deviation)

in HEG was 115.3 kcal and this is 252 kcal among US adults (37) that is much more than our results. As reported in Mistry' systematic review (38) excessive use of junk foods is one of the main individual risk factors for overweight and obesity in developing countries. It is notable that these food groups are nutrient-poor sources or empty calorie foods and raise the calorie intake without providing the required nutrients.

This study revealed that, in average, the mean consumption of refined grains in adult women was 388.86 gr/day. It is reported that refined grain intake in Japanese adult women is 397 gr/day that is similar to our results (39) While it is recommended that at least half of the total grain intake should be from whole grains, our result showed that, on average refined grains consumption was three times more than whole grains. As reported by Shanthy Bowman whole-grain consumption of American adults was only one sixth of their total grain intakes (40). SARAH C reported that whole grains intake in 2 to 5 years old children in North Carolina was less than 13% of MyPyramid recommendations (41). Nick Rose in a cross sectional study demonstrated that the intake of whole grains as a percentage of total grain intake in US college students was 13% (42).The main cause of high intake of refined grains in Iran is wide consumption of polished rice. In major parts of the country, white rice is the primary staple food. Main reasons for high consumption of white rice lies in traditional customs; low price; greater palatability; ease of preparation; variety of preparation methods (43) In some other countries like China, India, Tanzania, Nigeria, Malaysia, Brazil and Costa Rica, white rice is one of the popular staple food of people (43) Two systematic reviews reported that higher consumption of white rice is associated with Cardio Vascular Diseases (CVD) risk factors (44) and significantly increased risk of type 2 diabetes (45).

As reported by previous studies there is a significant association between demographic variables and intakes of food groups (46, 47) and these results are similar to the findings of the present study that there was significant relationship between demographic variables and mean intake of 15 food groups. In our study there was no significant relationship between whole grains and junk food consumption with demographic variables. There was significant relationship between family income and daily energy intake. Women with high family income had more daily energy intakes. And it can be due to high consumption of added sugars, fast foods, liquid oils and refined grains because mean intake of these food groups was high in women with high income. Mean intakes of meats and nuts & seeds in working, high educated and women with high family income were high and in contrast, in house wives, low income and low educated women frequent source of protein was from legumes. It can be due to the low cost of this food group (48). Women with low educational level consumed more solid fats and salty snacks and low dairy products, vegetables and fruits that can be due to lack of nutritional knowledge (49). Previous studies confirmed that there is significant association between higher educational level and higher diet quality (49-51). Alkerwi in a nationwide, cross-sectional study indicated that healthy food choices were associated with educational level and predominant factors associated with eating a high energy density diet included increasing age, being male and living below the poverty threshold (47).Working women had unhealthy dietary pattern rather than house wives. This is consistent with previous studies (50, 52). It could be due to haven`t enough time for planning a good diet and when they are in work place, they consume more unhealthy snacks like added sugars, fast foods and junk foods (52).

Compared with the DRI recommendation values, this study showed that nutrients deficiency in LEG is significantly more than the two other groups. Most people in LEG, NEG and HEG consumed fat-soluble vitamins (A, E, K and D) and potassium less than 80% of RDI recommendations. Most people in the LEG consumed calcium less than 80% of DRI recommendation. Vitamin D and calcium deficiency is a major public health problem worldwide (53-55). Other studies confirm our results that approximately 80% of Iranians do not meet the estimated average requirement for calcium and vitamin D (56, 57).

High percentage of participants in HEG and NEG received potassium less than 80% of DRI recommendations. On the other hand, most of the subjects in three energy groups used some nutrients more than the recommended amount which includes: Sodium, protein, thiamin, riboflavin, biotin and vitamin B6.

Most of subjects in low and half of subjects in NEG consumed iron less than 80% DRI recommenda-

tions which confirms the results of other studies on low iron intake among women (55, 58-60). Iron deficiency anemia is one of the most common nutrient deficiencies in the world which can be the result of low dietary iron intake (54, 61). Our results suggest that sodium intake in HEG was more than three times, in NEG was more than 2.5 times and in LEG was double the DRI recommendation. Considering other recommendations about sodium intake that is 2300 mg/d in 2015-2020 Dietary Guideline for Americans (30) and 2400 mg/d in British Dietary Reference Values (DRVs) (62) daily sodium intake in HEG and NEG was double the recommendations. As seen in this study, other studies have shown that sodium intake in most of people is above the upper recommended limits (60, 63, 64).

Potassium intake in more than 50% of subjects in all the three energy groups was less than 80% of DRI recommendation. Other studies have also shown this (40, 64). Low potassium and high sodium intake are associated with an increased risk of hypertension, cardiovascular diseases and heart stroke (65-67)

The study had a few limitations. First, the study did not include dietary supplement used by the women, but it was reported on nutrients obtained through food intake. Under and over reporting on dietary assessments is a serious and pervasive problem in dietary surveys. Women relied on their memory to self-report dietary intakes and, therefore, data were subject to under or over reporting of energy.

Conclusions

This study reveals that high percentage of women did not meet the guidelines for certain food groups and nutrients. Educational level, job and income seem to be variables strongly related to dietary intake. Moreover, these results may constitute a baseline for planning healthy food and nutritional policies and improving dietary habits among women, which can have a positive impact on family nutritional habits.

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References

1. WHO. Global status report on noncommunicable diseases 2010. Geneva: World Health Organization; 2011.
2. Rees K, Hartley L, Flowers N, Clarke A, Hooper L, Thorogood M, et al. 'Mediterranean' dietary pattern for the primary prevention of cardiovascular disease. Cochrane Database Syst Rev. 2013; 8: Cd009825.
3. Baer DJ, Rice Bradley BH, Kris-Etherton P, Mente A, de Oliveira Otto M. Insights and perspectives on dietary modifications to reduce the risk of cardiovascular disease. Adv Nutr. 2014; 5 (5): 553-5.
4. Maghsoudi Z, Azadbakht L. How dietary patterns could have a role in prevention, progression, or management of diabetes mellitus? Review on the current evidence. J Res Med Sci. 2012; 17 (7): 694-709.
5. Alhazmi A, Stojanovski E, McEvoy M, Garg ML. The association between dietary patterns and type 2 diabetes: a systematic review and meta-analysis of cohort studies. J Hum Nutr Diet. 2014; 27 (3): 251-60.
6. Couto E, Boffetta P, Lagiou P, Ferrari P, Buckland G, Overvad K, et al. Mediterranean dietary pattern and cancer risk in the EPIC cohort. Br J Cancer. 2011; 104 (9): 1493-9.
7. Link LB, Canchola AJ, Bernstein L, Clarke CA, Stram DO, Ursin G, et al. Dietary patterns and breast cancer risk in the California Teachers Study cohort. Am J Clin Nutr. 2013; 98 (6): 1524-32.
8. Mobarakeh ZS, Mirzaei K, Hatmi N, Ebrahimi M, Dabiran S, Sotoudeh G. Dietary habits contributing to breast cancer risk among Iranian women. Asian Pac J Cancer Prev. 2014; 15 (21): 9543-7.
9. Edefonti V, Nicolussi F, Polesel J, Bravi F, Bosetti C, Garavello W, et al. Nutrient-based dietary patterns and nasopharyngeal cancer: evidence from an exploratory factor analysis. Br J Cancer. 2014.
10. Mirmiran P, Fallah Ghohroudy A, Hosseinpour Niazi S, Ahmadi B, Nayeri F, Azizi F. Dietary Patterns and Non Communicable Disease Among Iranian Women: A Systematic Review. Women's Health Bull. 2014; 1 (3): e21358.
11. Popkin BM, Adair LS, Ng SW. Global nutrition transition and the pandemic of obesity in developing countries. Nutr Rev. 2012; 70 (1): 3-21.
12. Mehio Sibai A, Nasreddine L, Mokdad AH, Adra N, Tabet M, Hwalla N. Nutrition transition and cardiovascular disease risk factors in Middle East and North Africa countries: reviewing the evidence. Ann Nutr Metab. 2010; 57 (3-4): 193-203.
13. Akbari F, Azadbakht L. A systematic review on diet quality among Iranian youth: focusing on reports from Tehran and Isfahan. Arch Iran Med. 2014; 17 (8): 574-84.
14. Struijk EA, Beulens JW, May AM, Fransen HP, Boer JM, de Wit GA, et al. Dietary patterns in relation to disease burden

expressed in Disability-Adjusted Life Years. Am J Clin Nutr. 2014; 100 (4): 1158-65.
15. Tognon G, Lissner L, Saebye D, Walker KZ, Heitmann BL. The Mediterranean diet in relation to mortality and CVD: a Danish cohort study. Br J Nutr. 2014; 111 (1): 151-9.
16. Elliot V, Lutter Ch, Lamstein S, Koniz-Booher P, Caulfield L. Systematic Review of the Dietary Intakes of Adolescent Girls in Low- and Middle-Income Countries. The Journal of the Federation of American Societies for Experimental Biology. 2015; 29 (898.4).
17. Savage JS, Fisher JO, Birch LL. Parental influence on eating behavior: conception to adolescence. J Law Med Ethics. 2007; 35 (1): 22-34.
18. Johnson CM, Sharkey JR, Dean WR, Alex McIntosh W, Kubena KS. It's who I am and what we eat. Mothers' food-related identities in family food choice. Appetite. 2011; 57 (1): 220-8.
19. Fisk CM, Crozier SR, Inskip HM, Godfrey KM, Cooper C, Robinson SM. Influences on the quality of young children's diets: the importance of maternal food choices. Br J Nutr. 2011; 105 (2): 287-96.
20. B J Sadock, V A Sadock, P Ruiz. Kaplan and Sadock's Synopsis of Psychiatry: Behavioral Sciences/Clinical Psychiatry 11 ed. Philadelphia: Lippincott Williams and Wilkins; 2015. 97-8, 170 p.
21. Poorolajal J, Zamani R, Mir-Moeini R, Amiri B, Majzoobi M, Erfani H, et al. Five-year Evaluation of Chronic Diseases in Hamadan, Iran: 2005-2009. Iran J Public Health. 2012; 41 (3): 71-81.
22. Esfahani FH, Asghari G, Mirmiran P, Azizi F. Reproducibility and relative validity of food group intake in a food frequency questionnaire developed for the Tehran Lipid and Glucose Study. J Epidemiol. 2010; 20 (2): 150-8.
23. Mirmiran P, Esfahani FH, Mehrabi Y, Hedayati M, Azizi F. Reliability and relative validity of an FFQ for nutrients in the Tehran lipid and glucose study. Public Health Nutr. 2010; 13 (5): 654-62.
24. Azar M, Sarkisian E. Food composition table of Iran. Tehran: National Nutrition and Food Research Institute, Shaheed Beheshti University; 1980. 65 p.
25. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. . Washington (DC): The National Academies Press; 2002.
26. U. S. Department of Agriculture US, Department of Health and Human Services. Dietary Guidelines for Americans. Washington, DC: U.S. Government Printing Office; December 2010.
27. Kolahdooz F, Najafi F. Report of a National Survey : Food Security Information and Mapping System in Iran. Tehran, Iran: 2012.
28. Ghassemi H, Harrison G, Mohammad K. An accelerated nutrition transition in Iran. Public Health Nutr. 2002; 5 (1a): 149-55.
29. McCrory MA, McCrory MA, Hajduk CL, Roberts SB. Procedures for screening out inaccurate reports of dietary energy intake. Public Health Nutr. 2002; 5 (6a): 873-82.
30. U. S. Department of Health and Human Services and U S, Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans.: December 2015. 8th Edition:[Available from: http://health.gov/dietaryguidelines/2015/guidelines/.
31. Almoosawi S, Vingeliene S, Karagounis LG, Pot GK. Chrono-nutrition: a review of current evidence from observational studies on global trends in time-of-day of energy intake and its association with obesity. Proc Nutr Soc. 2016: 1-14.
32. Mozaffarian D. Dietary and Policy Priorities for Cardiovascular Disease, Diabetes, and Obesity: A Comprehensive Review. Circulation. 2016; 133 (2): 187-225.
33. Zomer E, Gurusamy K, Leach R, Trimmer C, Lobstein T, Morris S, et al. Interventions that cause weight loss and the impact on cardiovascular risk factors: a systematic review and meta-analysis. Obes Rev. 2016.
34. Kafeshani O, Sarrafzadegan N, Nouri F, Mohammadifard N. Major dietary patterns in Iranian adolescents: Isfahan Healthy Heart Program, Iran. ARYA Atheroscler. 2015; 11 (Suppl 1): 61-8.
35. Zhang Z, Gillespie C, Welsh JA, Hu FB, Yang Q. Usual intake of added sugars and lipid profiles among the U.S. adolescents: National Health and Nutrition Examination Survey, 2005-2010. J Adolesc Health. 2015; 56 (3): 352-9.
36. Brisbois TD, Marsden SL, Anderson GH, Sievenpiper JL. Estimated intakes and sources of total and added sugars in the Canadian diet. Nutrients. 2014; 6 (5): 1899-912.
37. Bleich SN, Wolfson JA. U.S. adults and child snacking patterns among sugar-sweetened beverage drinkers and non-drinkers. Prev Med. 2015; 72: 8-14.
38. Mistry SK, Puthussery S. Risk factors of overweight and obesity in childhood and adolescence in South Asian countries: a systematic review of the evidence. Public Health. 2015; 129 (3): 200-9.
39. Okubo H, Sasaki S, Murakami K, Yokoyama T, Hirota N, Notsu A, et al. Designing optimal food intake patterns to achieve nutritional goals for Japanese adults through the use of linear programming optimization models. Nutr J. 2015; 14: 57.
40. Bowman S. Low economic status is associated with suboptimal intakes of nutritious foods by adults in the National Health and Nutrition Examination Survey 1999-2002. Nutrition Research. 2007; 27 (9): 515-23.
41. Ball SC, Benjamin SE, Ward DS. Dietary intakes in North Carolina child-care centers: are children meeting current recommendations? J Am Diet Assoc. 2008; 108 (4): 718-21.
42. Rose N, Hosig K, Davy B, Serrano E, Davis L. Whole-grain intake is associated with body mass index in college students. J Nutr Educ Behav. 2007; 39 (2): 90-4.
43. Mattei J, Malik V, Wedick NM, Hu FB, Spiegelman D, Willett WC, et al. Reducing the global burden of type 2 diabetes by improving the quality of staple foods: The Global Nutrition and Epidemiologic Transition Initiative. Global Health. 2015; 11: 23.
44. Izadi V, Azadbakht L. Is there any association between rice consumption and some of the cardiovascular diseases risk factors? A systematic review. ARYA Atheroscler. 2015; 11 (Suppl 1): 109-15.
45. Hu EA, Pan A, Malik V, Sun Q. White rice consumption and

risk of type 2 diabetes: meta-analysis and systematic review. Bmj. 2012; 344: e1454.
46. Arruda SP, da Silva AA, Kac G, Goldani MZ, Bettiol H, Barbieri MA. Socioeconomic and demographic factors are associated with dietary patterns in a cohort of young Brazilian adults. BMC Public Health. 2014; 14: 654.
47. Alkerwi A, Vernier C, Sauvageot N, Crichton GE, Elias MF. Demographic and socioeconomic disparity in nutrition: application of a novel Correlated Component Regression approach. BMJ Open. 2015; 5 (5): e006814.
48. Drewnowski A, Eichelsdoerfer P. Can Low-Income Americans Afford a Healthy Diet? Nutr Today. 2010; 44 (6): 246-9.
49. Alkerwi A, Sauvageot N, Malan L, Shivappa N, Hebert JR. Association between nutritional awareness and diet quality: evidence from the observation of cardiovascular risk factors in Luxembourg (ORISCAV-LUX) study. Nutrients. 2015; 7 (4): 2823-38.
50. Thorpe MG, Milte CM, Crawford D, McNaughton SA. A Revised Australian Dietary Guideline Index and Its Association with Key Sociodemographic Factors, Health Behaviors and Body Mass Index in Peri-Retirement Aged Adults. Nutrients. 2016; 8 (3): 160.
51. Thornton LE, Pearce JR, Ball K. Sociodemographic factors associated with healthy eating and food security in socio-economically disadvantaged groups in the UK and Victoria, Australia. Public Health Nutr. 2014; 17 (1): 20-30.
52. Kim SY, Kim SM. Energy intake and snack choice by the meal patterns of employed people. Nutr Res Pract. 2010; 4 (1): 43-50.
53. Agarwal S, Reider C, Brooks JR, Fulgoni VL, 3rd. Comparison of prevalence of inadequate nutrient intake based on body weight status of adults in the United States: an analysis of NHANES 2001-2008. J Am Coll Nutr. 2015; 34 (2): 126-34.
54. Berti PR, Fallu C, Cruz Agudo Y. A systematic review of the nutritional adequacy of the diet in the Central Andes. Rev Panam Salud Publica. 2014; 36 (5): 314-23.
55. Elliot V, Lutter Ch, Lamstein S, Koniz-Booher P, Caulfield L. Systematic Review of the Dietary Intakes of Adolescent Girls in Low- and Middle-Income Countries. The Journal of the Federation of American Societies for Experimental Biology. 2015; 29 (898.4).
56. National assessment of iron, zinc, calcium, vitamin A and vitamin D in different age groups. Tehran: Final report of national survey, 2005.
57. K. Moradzadeh, B. Larijani, A.A. Keshtkar, A. Hossein-Nezhad, R. Rajabian, I. Nabipour, et al. Normative Values of Vitamin D Among Iranian Population: A Population Based Study. International Journal of Osteoporosis and Metabolic Disorders. 2008; 1 (1): 8-15.
58. Azadbakht L, Esmaillzadeh A. Macro and Micro-Nutrients Intake, Food Groups Consumption and Dietary Habits among Female Students in Isfahan University of Medical Sciences. Iran Red Crescent Med J. 2012; 14 (4): 204-9.
59. Diethelm K, Huybrechts I, Moreno L, De Henauw S, Manios Y, Beghin L, et al. Nutrient intake of European adolescents: results of the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study. Public Health Nutr. 2014; 17 (3): 486-97.
60. Bowman S. Low economic status is associated with suboptimal intakes of nutritious foods by adults in the National Health and Nutrition Examination Survey 1999-2002. Nutrition Research. 2007; 27 (9): 515-23.
61. John W. Erdman Jr, Ian A. MacDonald, Steven H. Zeisel. Present Knowledge in Nutrition. 10 ed: Wiley-Blackwell; 2012.
62. Gandy J. Manual of dietetic practice. 5th ed: Wiley-Blackwell; 2014.
63. Oyebode O, Oti S, Chen YF, Lilford RJ. Salt intakes in sub-Saharan Africa: a systematic review and meta-regression. Popul Health Metr. 2016; 14: 1.
64. O'Neil CE, Nicklas TA, Zanovec M, Cho S. Whole-grain consumption is associated with diet quality and nutrient intake in adults: the National Health and Nutrition Examination Survey, 1999-2004. J Am Diet Assoc. 2010; 110 (10): 1461-8.
65. Cook NR, Obarzanek E, Cutler JA, Buring JE, Rexrode KM, Kumanyika SK, et al. Joint effects of sodium and potassium intake on subsequent cardiovascular disease: the Trials of Hypertension Prevention follow-up study. Arch Intern Med. 2009; 169 (1): 32-40.
66. Aaron KJ, Sanders PW. Role of dietary salt and potassium intake in cardiovascular health and disease: a review of the evidence. Mayo Clin Proc. 2013; 88 (9): 987-95.
67. D'Elia L, Barba G, Cappuccio FP, Strazzullo P. Potassium intake, stroke, and cardiovascular disease a meta-analysis of prospective studies. J Am Coll Cardiol. 2011; 57 (10): 1210-9.

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