



Dietary Patterns and Their Association with Sociodemographic and Lifestyle Determinants in Kashan, Iran: A Cross-Sectional Study

Faezeh Asgari Tarazoj; MSc¹, Nasrin Sharifi; PhD², Fatemeh Atoof; PhD³, Rouhullah Dehghani; PhD^{1,4}, Davarkhah Rabbani; PhD^{1,4}, Mohammad Bagher Miranzadeh; PhD^{1,4}, Mohammadreza Mazandarani; MSc², Reza Sharafati Chaleshtori; PhD², Gholamreza Mostafaii; PhD^{*1,4}

¹ Department of Environmental Health Engineering, Faculty of Health, Kashan University of Medical Sciences, Kashan, Iran; ² Research Center for Biochemistry and Nutrition in Metabolic Diseases, Kashan University of Medical Sciences, Kashan, Iran; ³ Department of Biostatistics & Epidemiology, Faculty of Health, Kashan University of Medical Sciences, Kashan, Iran; ⁴ Social Determinants of Health Research Center, Kashan University of Medical Sciences, Kashan, Iran.

ARTICLE INFO

ORIGINAL ARTICLE

Article history:

Received: 3 Dec 2022

Revised: 15 Feb 2023

Accepted: 30 Feb 2023

*Corresponding author:

mostafai_gr@kaums.ac.ir

Social Determinants of Health
Research Center, Kashan
University of Medical
Sciences, Kashan, Iran

Postal code: 8715973474

Tel: +98 031-55589444

ABSTRACT

Background: Dietary patterns (DPs) are a combination of nutrients which are determined through feeding behaviors of a particular population. Paying attention to DPs gives us a good picture of the diet and eating habits of people in the community. DPs help identify people at risk of chronic nutrition-related illnesses and give them nutritional advice. In the present study, the authors determine the DPs of people in Kashan city, Iran. **Methods:** This cross-sectional study was conducted to determine the DPs of the Kashan population from September 2019 to March 2020. A validated food frequency questionnaire (FFQ) was used to collect sociodemographic and dietary data. Then, DPs were assessed using principal component analysis. **Results:** The results showed that the average consumption of food items in cereals and products based on cereals, fruits and fruit products, vegetables and their products, meat and meat products, and milk and dairy products were 282.38 ± 65.71 , 287.58 ± 8.89 , 364.17 ± 21.05 , 34.48 ± 3.81 , and 456.65 ± 39.16 g/day, respectively. The identified DPs included: 1) Unhealthy and processed, 2) fruit and fruit-based products, 3) Kashan traditional food, 4) Healthy diet, and 5) Mixed diet. **Conclusion:** Findings of the present study reveal that sociodemographic factors and lifestyle are associated with food choices. In addition, the authors found the low consumption of grains, fruits, vegetables, and meat and their products in the studied population. The researchers call for nutritional interventions to modify the consumption pattern for these food items.

Keywords: Cross-sectional; Dietary pattern; Lifestyle; Factor analysis

Introduction

Access to sufficient and healthy food is one of the main axes of societal development and health (Gholizadeh *et al.*, 2017). The nutritional status of any individual in society depends on several factors, such as age, gender, cultural factors, economic status, level of education, etc. (Keramati *et al.*, 2015, Rostami *et al.*, 2016).

Nutritionists adopt a dietary pattern perspective to investigate the impact of diet on health outcomes (Esmaeilzadeh *et al.*, 2007, Fabiani *et al.*, 2016). In the past, the lack of food and diseases were the main health problems of human societies. However, the main problem today is inadequate attention to healthy nutrition and improper food

This paper should be cited as: Asgari Tarazoj F, Sharifi N, Atoof F, Dehghani R, Rabbani D, Bagher Miranzadeh M, et al. *Dietary Patterns and Their Association with Sociodemographic and Lifestyle Determinants in Kashan, Iran: A Cross-Sectional Study*. *Journal of Nutrition and Food Security (JNFS)*, 2024; 9(3): 477-486.

consumption (Rostami *et al.*, 2016). DPs are related to obesity, metabolic syndrome, diabetes, cancer development, and other risk factors of cardiovascular diseases (Batis *et al.*, 2016, Rashidkhani *et al.*, 2008, Sun *et al.*, 2016), and chronic diseases resulting from improper diet and lifestyle are the leading causes of death (Pasdar *et al.*, 2014). Sufficient food consumption during pregnancy plays a vital role in women's health, fetal growth, and birth weight (de Castro *et al.*, 2016, Ghasab Shirazi *et al.*, 2016). Over the last few decades, many epidemiological studies have confirmed that diet notably affects mental health (Li *et al.*, 2017), and studies in Europe have shown the effects of diet quality on developing depression, anxiety, and cognitive impairment in the elderly (Milte and McNaughton, 2016). Given the role of people's dietary habits and patterns in nutrient consumption over time and the development of nutrition-related diseases, addressing the DP in general and specific nutrients in particular are critical, albeit complicated (Tarighat-Esfanjani *et al.*, 2016). In addition to food-based dietary guidelines, promoting healthy DPs can help improve diet and health within a population (Ax *et al.*, 2016, Haghghatdoost *et al.*, 2012). In general, DPs can be defined as the amount, proportion, variety, or combination of different foods and drinks in diets and the frequency of their consumption (Schulze *et al.*, 2018). The DPs consisting of food intake complexity could give us a clear picture of the diet and of the nutritional habits of people in society. Moreover, these patterns help identify people with nutrition-related chronic diseases and offer nutritional recommendations due to their less familiarity with nutrient contents in food choices (Hosseyani Esfahani *et al.*, 2008). In other words, it is necessary to consider the combination of different foods that people often consume together based on diet recommendations and guides (Golabi *et al.*, 2016). Therefore, DPs reflect an individual's nutritional behavior; hence, analyzing dominant DPs can provide detailed information on the relationship between diseases and diet, interaction among nutrients, and to a large extent, the

correlation between food intake and nutrients (Mohammadshahi *et al.*, 2015). Nutrition training interventions combine educational strategies and environmental support to facilitate the adoption of healthy nutritional behaviors, which can be delivered at individual, community, and policy levels (Ghasab Shirazi *et al.*, 2016). Therefore, there is an urgent need to understand and compare broader DPs among the countries representing different geographic regions and developmental stages (Mikkilä *et al.*, 2015). It is quite evident that pinpointing dominant dietary patterns is different across different regions and cultures, and no comprehensive study has been conducted in Kashan in this domain. Therefore, this study reports on the DPs of people in Kashan.

Materials and Methods

Study population and dietary intake assessment

This cross-sectional study intended to determine the dietary patterns of people in Kashan from September 2019 to March 2020. The sample size based on the consumption ratio of vegetables, fruit, milk, yogurt and buttermilk, legumes, and rice was 0.17, 0.38, 0.13, 0.325, 0.18, and 0.36, respectively (Rostami *et al.*, 2016). The first kind of error of 5% and estimated error of 4% were obtained as 338, 565, 272, 526, 354 and 553, respectively. In this study, more samples (n=562) were selected. Since cluster sampling was used, the total number of samples was equal to $562 \times 1.7 = 955$ based on the effect design of 1.7. Kashan was divided into seven districts based on socioeconomic status, and then, blocks were made based on neighborhoods in each district. According to the weight of each district and the number of blocks, the number of households in each cluster was determined using systematic random selection (the weight of the categories was obtained from the cooperation of the health centers at Kashan University of Medical Sciences. The centers in each district were considered clusters, and the experts of those centers were recruited. The authors conducted a study in each neighborhood by considering the high number of referrals to the

centers and the distribution of the covered population). The households were randomly selected from the list of households in each cluster. Households were contacted and mothers were asked (Azadbakht *et al.*, 2012) to refer to the center for examination. In order to collect information on people's diet, the food frequency questionnaire (FFQ), which is already validated in Iran, was used (Pasdar *et al.*, 2014). Moreover, the validity and reliability of this questionnaire were confirmed in many studies in Iran (Esfahani *et al.*, 2010, Hosseinpour-Niazi *et al.*, 2013, Rashidkhani *et al.*, 2011). FFQ is a tool to determine the consumption of food items over the past year (Xu *et al.*, 2016).

Participants were excluded if they had at least one of the following characteristics: 1) No FFQ was completed; 2) Less than 30 items were consumed according to the completed FFQ; 3) There was no data for sociodemographic and lifestyle determinants.

Ethical considerations

It is worth mentioning that this paper was part of the research project 98173 of the Vice-Chancellor for Research, Kashan University of Medical Sciences, Kashan, with an ethics code of IR.KAUMS.MEDNT.REC.1398.114 approved by the University Ethics Committee.

Data analysis

In this study, the food data extracted from the questionnaire was first converted into grams by Nutrition4 software for each person. Finally, SPSS

was used to analyze the relevant information. The data obtained from the 144 food item FFQs were used to determine dietary patterns using factor analysis by SPSS. Then, the researchers described the data using descriptive statistics, such as measures of central tendency and dispersion for the quantitative variables. Absolute and relative frequency was used to describe the qualitative variables. Moreover, the authors drew essential tables and diagrams for the variables. Then, the dominant dietary patterns were obtained from the factor analysis. In this study, factor loading values greater than 0.2 were considered to determine dietary groups in each dietary pattern. Factor loading indicated the correlation coefficient between a dietary group and any dietary pattern, with larger values showing a greater correlation and a positive or negative sign representing a direct or inverse relationship between that dietary group and the patterns. As such, the dietary patterns were obtained by placing the consumed food items in these factors and the factor loading values of the groups.

Results

Demographic information, including age, marital status, and level of education is presented in **Table 1**. The results of the principal components analysis are shown in **Table 2**.

Five dietary patterns were identified, explaining 35.4% of the overall variance. The DPs included: 1) Unhealthy and processed, 2) Fruit and fruit-based products, 3) Kashan traditional, 4) Healthy, and 5) Mixed.

Table 1. Demographic and anthropometric variables in the studied population (n=955).

| Variables | |
|---|----------------------------|
| Age (year) | 39.69 ± 13.80 ^a |
| Height (cm) | 165.72 ± 5.80 |
| Weight (kg) | 67.65 ± 10.53 |
| Body mass index (kg/m ²) | 24.71 ± 4.14 |
| Employment status | |
| Housewife | 565 (59.2) ^b |
| Employed | 390 (40.8) |
| Education status | |
| High school diploma | 272 (28.5) |
| High school diploma to Bachelor's degree | 591 (61.9) |
| Master's degree and higher | 92 (9.6) |
| Economic status | |
| Poor | 120 (12.6) |
| Average | 473 (49.5) |
| Good | 362 (37.9) |
| Frequency of people with hypertension | 164 (17.2) |
| Frequency of diabetics | 85 (8.9) |
| Frequency of people with cardiovascular disease | 131 (13.7) |
| Frequency of people with cancer | 28 (2.9) |
| Frequency of obese people | 237 (24.8) |
| Frequency of people with anemia | 343 (35.9) |
| Smoking | 17 (1.8) |
| Alcohol consumption | 2 (0.2) |
| Frequency of people with a family history of hypertension | 403 (42.2) |
| Frequency of people with a family history of diabetes | 266 (27.9) |
| Frequency of people with a family history of cardiovascular disease | 305 (31.9) |
| Frequency of people with a family history of cancer | 148 (15.5) |
| Frequency of people with a family history of obesity | 275 (28.8) |
| Frequency of people with a family history of anemia | 231 (24.2) |

^a:Mean±SD; ^b: n(%)

Table 2. Factor load of food groups in dietary patterns in Kashan population.

| Unhealthy and processed | | Fruit and fruit-based products | | Kashan traditional food | | Healthy | | Mixed | |
|-------------------------|-------|--------------------------------|-------|-------------------------|-------|----------------|-------|-------------------|-------|
| Food items | FLV | Food items | FLV | Food items | FLV | Food items | FLV | Food items | FLV |
| Puff Paste | 0.705 | Peach | 0.776 | Homemade Halva | 0.297 | Cooked Beans | 0.233 | Macaroni | 0.235 |
| Mayonnaise | 0.678 | Nectarine | 0.770 | Tea | 0.252 | Bean | 0.391 | Grapefruit | 0.348 |
| Pizza | 0.630 | Plum | 0.734 | Tongue | 0.795 | Cream | 0.353 | Tuna | 0.273 |
| Industrial Ice-cream | 0.612 | Apricot | 0.707 | Brain | 0.793 | Buttermilk | 0.265 | Coffee | 0.255 |
| Confetti | 0.610 | Persimmon | 0.684 | Head | 0.784 | Soya | 0.338 | Almond | 0.217 |
| Sauce | 0.602 | Kiwi | 0.676 | Feet | 0.770 | Groundnut | 0.240 | Mushrooms | 0.220 |
| Pickle | 0.559 | Cherry | 0.662 | Tripe | 0.612 | Margarine | 0.200 | Thin green pepper | 0.259 |
| Chips | 0.558 | Tangerine | 0.657 | Sohan | 0.541 | Corn | 0.293 | Stewed pumpkin | 0.216 |
| Baguette Bread | 0.545 | Pomegranate | 0.631 | Haslet | 0.525 | Dried mulberry | 0.351 | Potato | 0.227 |
| Soda | 0.542 | Pear | 0.622 | Gaz | 0.503 | Vermicelli | 0.573 | Tomato | 0.648 |
| Acerbity | 0.541 | Fig | 0.607 | Animal Oil | 0.411 | Lettuce | 0.568 | Full fat yogurt | 0.601 |

| | | | | | | | | | |
|----------------|-------|--------------|-------|-----------------------|-------|-------------------|-------|-------------------|-------|
| Cookie | 0.539 | Lemons | 0.607 | Taftoun bread | 0.321 | Peas | 0.540 | Cooked vegetables | 0.580 |
| Biscuit | 0.539 | Apple | 0.547 | Beef | 0.288 | Lentil | 0.539 | Cabbage | 0.558 |
| Raw onion | 0.537 | Strawberries | 0.536 | Whey | 0.256 | Green live | 0.510 | Raw onion | |
| Candy | 0.536 | Banana | 0.531 | Vetch | 0.203 | Sweet Oil | 0.502 | Full fat milk | 0.517 |
| Sugar | 0.536 | Greengage | 0.517 | Traditional ice-cream | 0.294 | Bulgur | 0.486 | Chicken | 0.516 |
| Chocolate | 0.534 | Berry | 0.516 | | | Squash | 0.480 | Lemon juice | 0.514 |
| Sausage | 0.530 | Watermelon | 0.501 | | | Ash Reshteh | 0.478 | Strained yogurt | 0.484 |
| Butter | 0.513 | Date | 0.450 | | | Fruit compote | 0.462 | Cucumber | 0.474 |
| Fried potato | 0.509 | Cantaloupe | 0.445 | | | Baked green beans | 0.441 | Barbari bread | 0.473 |
| Cake | 0.500 | Orange | 0.445 | | | Celery | 0.434 | Minced meat | 0.456 |
| Bologna | 0.488 | Melon | 0.382 | | | Turnip | 0.415 | Salty pickle | 0.434 |
| Salt | 0.480 | Grape | 0.376 | | | Pea | 0.413 | Sangak bread | 0.429 |
| Cream pastries | 0.470 | Dried fig | 0.213 | | | Eggplant | 0.397 | Mutton | 0.418 |
| Hamburger | 0.465 | Dried fruit | 0.283 | | | Split pea | 0.395 | Fried onion | 0.416 |
| Chocolate milk | 0.464 | Sour lemon | 0.250 | | | Low-fat milk | 0.394 | Hazelnut | 0.396 |
| Halva | 0.464 | | | | | Raw carrot | 0.393 | Bell pepper | 0.386 |
| Jam | 0.452 | | | | | Raisin | 0.386 | Cream cheese | 0.381 |
| Seed | 0.440 | | | | | Fish | 0.348 | Egg | 0.340 |
| Lavash bread | 0.335 | | | | | Walnuts | 0.325 | Rice | 0.322 |
| Liquid oil | 0.299 | | | | | Vegetable | 0.317 | Garlic | 0.295 |
| Crackers | 0.231 | | | | | Pistachio | 0.253 | Cheese | 0.253 |
| Juice box | 0.252 | | | | | Spinach | 0.376 | | |
| | | | | | | Cooked carrots | 0.247 | | |
| | | | | | | Honey | 0.214 | | |
| | | | | | | Apple juice | 0.309 | | |
| | | | | | | Orange Juice | 0.232 | | |
| | | | | | | Yogurt | 0.215 | | |

FLV: Factor loadings values of less than 0.2 were removed for simplification.

The results showed that the consumption of unhealthy, processed, and Kashan traditional dietary patterns was reduced in accordance with age. With weight gain, the consumption of unhealthy and processed dietary patterns and fruit and fruit-based products declined. Furthermore, the consumption of unhealthy and processed dietary patterns and fruit and fruit-based products showed a declining trend based on BMI. The results of comparison are shown in **Table 3**. The association between sociodemographic and lifestyle of the participants and the five dietary patterns are summarized in **Table 4**. The results showed that a higher level of education was associated with the consumption of unhealthy and processed dietary patterns ($P<0.001$)

and fruit and fruit-based products ($P<0.034$). On the other hand, low educational level corresponded to consuming mixed dietary patterns ($P<0.001$). The results further indicated that people with diabetes rarely ate unhealthy and processed patterns ($P<0.001$) and relied more on healthy patterns ($P<0.001$). The authors found that people suffering from cardiovascular diseases frequently had healthy dietary patterns ($P<0.001$) and rarely used unhealthy and processed ($P<0.004$) traditional ($P<0.027$) and mixed patterns ($P<0.001$). In addition, people with cancer consumed less unhealthy, processed ($P<0.041$), and mixed patterns ($P<0.049$) and relied more on fruit and fruit-based products ($P<0.014$) and healthy patterns ($P<0.014$).

Table 3. Correlation coefficient between dietary patterns, age and anthropometric variables in the studied population.

| Variables | Unhealthy and processed food | Fruit and fruit-based products | Kashan traditional food | Healthy | Mixed |
|-----------------|------------------------------|--------------------------------|-------------------------|---------------|-------------|
| Age | -0.28 (<0.001) ^a | 0.06 (0.07) | -0.16 (<0.001) | 0.19 (<0.001) | 0.02 (0.56) |
| Weight | -0.11 (0.01) | -0.08 (0.02) | 0.07 (0.04) | -0.04 (0.23) | 0.05 (0.15) |
| Body mass index | -0.14 (<0.001) | -0.05 (0.11) | 0.06 (0.05) | -0.02 (0.49) | 0.07 (0.02) |

^a: r (P-value)

Table 4. Association between sociodemographic and lifestyle and dietary patterns in the studied population.

| Variables | Unhealthy and processed food | Fruit and fruit-based products | Kashan traditional food | Healthy | Mixed |
|---|------------------------------|--------------------------------|-------------------------|---------|--------|
| Employment status | <0.001 | 0.99 | 0.18 | 0.004 | <0.001 |
| Education status | <0.001 | 0.034 | 0.137 | 0.736 | <0.001 |
| Economic status | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Diabetes | <0.001 | 0.332 | 0.528 | <0.001 | 0.258 |
| Cardiovascular diseases | 0.004 | 0.485 | 0.027 | <0.001 | 0.001 |
| Cancer | 0.041 | 0.014 | 0.162 | 0.014 | 0.049 |
| Overweight and obese | 0.005 | 0.007 | <0.001 | 0.616 | <0.001 |
| Hypertension | <0.001 | 0.370 | 0.664 | <0.001 | 0.849 |
| Anemia | <0.001 | 0.022 | 0.165 | 0.151 | 0.031 |
| Smoking | 0.585 | 0.143 | 0.834 | 0.127 | 0.684 |
| Alcohol consumption | 0.318 | 0.270 | 0.061 | 0.052 | 0.332 |
| Family history of diabetes | 0.017 | 0.517 | <0.001 | 0.701 | <0.001 |
| Family history of cardiovascular diseases | 0.280 | 0.340 | <0.001 | 0.040 | 0.818 |
| Family history of cancer | 0.426 | 0.904 | <0.001 | 0.148 | 0.131 |
| Family history of overweight and obesity | 0.016 | <0.001 | <0.001 | 0.825 | <0.001 |
| Family history of hypertension | 0.003 | 0.031 | 0.211 | 0.070 | 0.061 |
| Family history of anemia | 0.032 | <0.001 | 0.825 | 0.007 | 0.794 |

To determine the average consumption of dietary groups, first the average daily consumption of food items in g was obtained. Then, based on the given dietary groups, their per capita consumption was acquired. The results are shown in **Table 5**. Based on the studied dietary groups, the per capita consumption was compared with the one in 4 clusters from around the world. Iran was in G₆, and the European Union countries were in G₇, according to GEMS/Food Consumption Cluster Diets (**Table 6**).

Discussion

In this study, based on per capita consumption of dietary cluster, the average consumption of fruit and fruit-based products, vegetables and vegetable-based products, cereals and cereal-

based products, and meat and meat-based products in Kashan was lower than the national standard (G₆). Nonetheless, the consumption of milk and dairy products was higher than the standard. The results showed the consumption of fruit and fruit-based products, vegetables and vegetable-based products, and milk and dairy products in the developing Asian countries of the G₁ and G₅, such as Tunisia, Afghanistan, Pakistan, and India, was lower compared to people from Kashan. In addition, the consumption of grain and meat in those countries was higher than Kashan. Moreover, it was found that the consumption of fruit and fruit-based products, vegetables and vegetable-based products, cereals and cereal-based products, and milk and dairy products in

the developed countries in Europe and America- G₇ and G₁₀- such as Canada, New Zealand, Switzerland, Australia, and Norway, was lower

compared to the one in Kashan. Their meat consumption was also higher than that of Kashan population.

Table 5. Per capita consumption of food groups in Kashan population.

| Food groups | Standard value G6 | Per capita consumption in Kashan (gram) | P-value ^b |
|--|----------------------|--|----------------------|
| Grains and grain-based products | 484 | 282.38±65.71 ^a | <0.001 |
| Fruit and fruit-based products | 420 | 287.58±8.89 | <0.001 |
| Vegetables and vegetables-based products | 441 | 364.17±21.05 | <0.001 |
| Meat and meat-based products | 77.1 | 34.48±3.81 | <0.001 |
| Milk and dairy products | 162 | 456.65±39.16 | <0.001 |

^a: Mean ±SD; ^b: Independent t-test.

Table 6. Comparing per capita consumption in diet cluster of European Union countries with the diet cluster in Kashan.

| Food groups | Per capita consumption in Kashan (g/day) | Cluster of European Union countries | | | | |
|--|---|-------------------------------------|------|------|------|------|
| | | G1 | G5 | G6 | G7 | G10 |
| Fruit and fruit-based products | 287.58 | 151 | 160 | 420 | 175 | 201 |
| Vegetables and vegetables-based products | 364.17 | 155 | 150 | 441 | 217 | 303 |
| Grains and grain-based products | 282.38 | 380 | 365 | 484 | 247 | 284 |
| Meat and meat-based products | 34.48 | 51 | 62.7 | 77.1 | 230 | 204 |
| Milk and dairy products | 456.65 | 261 | 177 | 162 | 325 | 279 |
| Egg | 23.95 | 9.26 | 11.6 | 17.1 | 29.8 | 29.3 |
| Fats | 12.22 | 39.1 | 33.6 | 40.2 | 79.9 | 75 |
| Fish and seafood | 7.23 | 8.77 | 16.7 | 24.6 | 45.3 | 56.1 |
| Spices, seasonings and sauces | 35.70 | 4.97 | 4.81 | 4.82 | 6.72 | 7.84 |
| Legumes and nuts | 50.07 | 20.5 | 50.6 | 38.3 | 15.7 | 27.3 |
| Sugar and sweets | 84.09 | 102 | 86.7 | 116 | 106 | 134 |

The study results showed that people with hypertension rarely ate processed and unhealthy food and depended more on healthy diets. Western, healthy, and traditional food included three dietary patterns in the studies by Roustaa, Haghghat Doust, Motaghi, and Shin (Haghghatdoost *et al.*, 2012, Mottaghi *et al.*, 2015, Roosta *et al.*, 2015, Shin *et al.*, 2013). People with a healthy diet had a lower chance of developing hypertension. In contrast, those who followed western dietary pattern had a higher chance of cardiovascular diseases and hypertension. The study results showed that the cases with cardiovascular diseases frequently consumed healthy food and used less unhealthy, processed, traditional, and mixed foods. In the studies by Hou and Eilat-Adar (Eilat-Adar *et al.*, 2013, Hou *et al.*, 2015), people who consumed healthy food had a lower chance of cardiovascular

diseases. The results showed that people with diabetes rarely had unhealthy and processed food and frequently used healthy food. Qian, Alhazmi, and Jannasch identified vegetarian (mostly healthy), healthy, unhealthy, and Mediterranean dietary patterns (Alhazmi *et al.*, 2014, Jannasch *et al.*, 2017, Qian *et al.*, 2019). In these studies, people who consumed more vegetarian and healthy food had a lower chance of diabetes. The results showed that those who were overweight and obese seldom ate unhealthy, processed, and fruit-based products and often had Kashan traditional and mixed food diets. In the studies by Esmailzadeh, Ghorbannejad, and Shanshin, healthy, western, traditional, high-protein, prepared foods, and salty snacks were identified (Esmailzadeh *et al.*, 2011, Ghorbannejad *et al.*, 2020, Nazary, 2015). People who consumed healthy food had a lower chance of

developing general and abdominal obesity, while those in the highest quintile of Western dietary patterns had a higher chance of general and abdominal obesity. Moreover, the high-protein dietary pattern was directly related to thinness. In this study, people with cancer hardly consumed unhealthy, processed, and mixed food, and frequently used healthy food and fruit and fruit-based products. In the same vein, Tazhibi *et al.* identified four dominant dietary patterns in the studied population (Tazhibi *et al.*, 2011). Moreover, no significant relationship was detected between dominant dietary patterns and colon cancer risk.

The present study had several limitations to note. The cross-sectional setting of the work only permitted establishing associations, and no causal inferences could be drawn. Furthermore, the portion size was self-reported and might have been misevaluated by the participants. Still, this is a common issue among self-reported dietary intake, and dietary patterns do not change significantly when input variable quantification changes. One of the strengths of this study was the use of state-of-the-art dietary assessment tools, which limited the possibility of bias. Besides, this analysis was carried out by nutritionists using N4 software. The data collection method for food intake was common in epidemiological studies, especially large-scale studies (Li *et al.*, 2017). Overall, the results implied that dietary patterns were closely related to lifestyle.

Conclusion

Five dietary patterns, namely unhealthy and processed, fruit and fruit products-based, traditional Kashan diet, and healthy, and mixed were identified in Kashan population. Then, numerous associated modifiable behaviors were determined. The data on sociodemographic determinants might adequately target the most vulnerable groups in public health interventions.

Acknowledgments

The authors acknowledge the generous financial/statistical/scientific support of Clinical Research Development Unit of Shahid Beheshti

Hospital in Kashan University of Medical sciences. The authors also would like to thank all the participants in the study.

Authors' contributions

Mostafaii GH and Sharafati Chaleshtori R designed the research. Asgari Tarazoj F and Mazandarani-fard M collected the data. Sharifi N and Atoof F conducted statistical analysis. Sharafati Chaleshtori R, Dehghani R, Rabbani D and Miranzadeh MB wrote the manuscript. Mostafaii GH, Sharafati Chaleshtori R and Asgari Tarazoj F had primary responsibility for final content, and all the authors read and approved the final manuscript.

Conflicts of interest

The authors declared no conflict of interests.

Funding

This study was funded by Kashan University of Medical Sciences (Grant No.: 98173).

References

- Alhazmi A, Stojanovski E, McEvoy M & Garg M** 2014. The association between dietary patterns and type 2 diabetes: a systematic review and meta-analysis of cohort studies. *Journal of human nutrition and dietetics*. **27** (3): 251-260.
- Ax E, et al.** 2016. Dietary patterns in Swedish adults; results from a national dietary survey. *British journal of nutrition*. **115** (1): 95-104.
- Azadbakht L, Shirani F & Esmazadeh A** 2012. Dietary intake and habits of female students in Isfahan University of Medical Sciences, Isfahan, Iran. *Journal of health services research*. **8** (5): 876-886.
- Batis C, et al.** 2016. Using both principal component analysis and reduced rank regression to study dietary patterns and diabetes in Chinese adults. *Public health nutrition*. **19** (2): 195-203.
- de Castro MBT, et al.** 2016. Sociodemographic characteristics determine dietary pattern adherence during pregnancy. *Public health nutrition*. **19** (7): 1245-1251.
- Eilat-Adar S, et al.** 2013. Dietary patterns and their association with cardiovascular risk factors in a population undergoing lifestyle changes: The

- Strong Heart Study. *Nutrition, metabolism and cardiovascular diseases*. **23** (6): 528-535.
- Esfahani FH, Asghari G, Mirmiran P & Azizi F** 2010. Reproducibility and relative validity of food group intake in a food frequency questionnaire developed for the Tehran Lipid and Glucose Study. *Journal of epidemiology*. **20** (2): 150-158.
- Esmailzadeh A, Azadbakht L, Khoshfetrat M & Kimiagar S** 2011. Major dietary patterns, general and central adiposity among tehrani female teachers. *Journal of research and health*. **6**: 676-689.
- Esmailzadeh A, Azadbakht L & Kimiagar SM** 2007. Dietary pattern analysis: a new approach to identify diet-disease relations. *Iranian journal of nutrition sciences and food technology*. **2** (2): 71-80.
- Fabiani R, Minelli L, Bertarelli G & Bacci S** 2016. A western dietary pattern increases prostate cancer risk: a systematic review and meta-analysis. *Nutrients*. **8** (10): 626.
- Ghasab Shirazi M, Kazemi A, Mostafavi Darani F & Kelishadi R** 2016. A nutrition education intervention trial for adolescent girls in Isfahan: Study Design and Protocol. *International journal of pediatrics*. **4** (11): 3847-3857.
- Gholizadeh H, Rostamian Motlagh Z, Badsar M & Shams A** 2017. Culture and nutrition knowledge, and their relationship with food insecurity among rural households in Kermanshah County, Iran. *Journal of rural research*. **8** (1): 54-67.
- Ghorbannejad H, Didarloo A, Bakhshimoghaddam F & Alizadeh M** 2020. Association of Dietary Patterns with Overweight and Obesity in Adolescents Female in Urmia. *Journal of Sabzevar University of medical sciences*. **21** (7): 7-17.
- Golabi F, Agayari Hir T & Saeed M** 2016. Study of the media's role in feeding behavior and its social context (case study: citizens over 15 years in Tabriz). *Journal of applied sociology*. **27** (1): 27-42.
- Haghighatdoost F, Zaribaf F, Azadbakht L & Esmailzadeh A** 2012. Association between major dietary patterns and risk factors for cardiovascular disease among women. *Iranian journal of nutrition sciences & food technology*. **7** (3): 19-30.
- Hosseinpour-Niazi S, Fallah A, Mirmiran P & Azizi F** 2013. Association between macronutrients and metabolic syndrome among adults. *Pajoohandeh journal*. **18** (1): 23-29.
- Hosseini Esfahani F, Jazayeri A, Mirmiran P, Mehrabi Y & Azizi F** 2008. Dietary patterns and their association with socio-demographic and lifestyle factors among Tehrani adults: Tehran Lipid and Glucose Study. *Journal of school of public health & institute of public health research*. **6** (1): 23-36.
- Hou L, et al.** 2015. Association between dietary patterns and coronary heart disease: a meta-analysis of prospective cohort studies. *International journal of clinical and experimental medicine*. **8** (1): 781.
- Jannasch F, Kröger J & Schulze MB** 2017. Dietary patterns and type 2 diabetes: a systematic literature review and meta-analysis of prospective studies. *Journal of nutrition*. **147** (6): 1174-1182.
- Keramati S, Delbari A, Kooshki A & Akaberi A** 2015. Study of the Nutritional Patterns of Adolescent Students (12-18years) in Sabzevar and Comparing it with the Standard Food Pyramid in 2006. *Bahaghi journal*. **13** (1): 6-11.
- Li Y, et al.** 2017. Dietary patterns and depression risk: A meta-analysis. *Psychiatry research*. **253**: 373-382.
- Mikkilä V, et al.** 2015. An international comparison of dietary patterns in 9–11-year-old children. *International journal of obesity supplements*. **5** (2): S17-S21.
- Milte CM & McNaughton SA** 2016. Dietary patterns and successful ageing: a systematic review. *European journal of nutrition*. **55** (2): 423-450.
- Mohammadshahi M, et al.** 2015. Evaluation of relationship between dietary patterns and quality of life in patients with type 2 diabetes. *Journal of Daneshvar medicine*. **22** (114): 1-12.

- Mottaghi A, Hosseini Esfahani F, Mirmiran P & Azizi F** 2015. Assessment of relationship between dietary patterns and incidence of hypertension: Tehran Lipid and Glucose Study. *Iranian journal of endocrinology and metabolism*. **16** (6): 433-440.
- Nazary F** 2015. Major dietary pattern and association with between obesity and central obesity in adult women of Bushehr city. *Iranian south medical journal*. **18** (1): 1-14.
- Pasdar Y, Rezaei M, Darbandi M, Mohamadi N & Niyazi P** 2014. Dietary Pattern and Food Consumption among Kermanshah Households, 2011. *Journal of Kerman University of Medical Sciences*. **20** (1): 25-36.
- Qian F, Liu G, Hu FB, Bhupathiraju SN & Sun Q** 2019. Association between plant-based dietary patterns and risk of type 2 diabetes: a systematic review and meta-analysis. *JAMA internal medicine*. **179** (10): 1335-1344.
- Rashidkhani B, Rezazadeh A, Omidvar N & Setayeshgar Z** 2008. Relationships of major dietary patterns and their association with socioeconomic and demographic factors in 20-50 year-old women in the north of Tehran. *Iranian journal of nutrition sciences & food technology*. **3** (2): 1-12.
- Rashidkhani B, et al.** 2011. Validity and reproducibility of a food frequency questionnaire for assessing dietary patterns in 18-45 years old women supported by health care in the north and east of Tehran. *Journal of Endocrinology and Metabolism*. **13** (1): 58-66.
- Roosta S, Falahi E & Cheraghi M** 2015. Association between hypertension and dietary patterns among adults residents of Khorramabad. *Iranian journal of endocrinology and metabolism*. **16** (5): 356-364.
- Rostami E, Taghdis MH, Dehdari T & Shirzad M** 2016. Exploring Household Food Consumption Patterns in Rural Areas of Felard in Lordegan in 2015. *Rahavard salamat journal*. **1** (2): 25-36.
- Schulze MB, Martínez-González MA, Fung TT, Lichtenstein AH & Forouhi NG** 2018. Food based dietary patterns and chronic disease prevention. *British medical journal*. **361**: 1-6.
- Shin J-Y, Kim J-M & Kim Y** 2013. Associations between dietary patterns and hypertension among Korean adults: the Korean National Health and Nutrition Examination Survey (2008-2010). *Nutrition research and practice*. **7** (3): 224-232.
- Sun Y, Li Z, Li J, Li Z & Han J** 2016. A healthy dietary pattern reduces lung cancer risk: a systematic review and meta-analysis. *Nutrients*. **8** (3): 134.
- Tarighat-Esfanjani A, Ebrahimi-Mameghani M, Asghari-Jafarabadi M, Jafari-Vayghan H & Ghadimi SS** 2016. Identification of major dietary patterns in Tabriz adults. *Medical Journal of Tabriz University of Medical Sciences*. **38** (2): 48-55.
- Tazhibi M, et al.** 2011. Association between major dietary patterns and risk of colon cancer. *Journal of Isfahan Medical School*. **28** (122).
- Xu S-H, et al.** 2016. Gender differences in dietary patterns and their association with the prevalence of metabolic syndrome among Chinese: a cross-sectional study. *Nutrients*. **8** (4): 180.