Relationship between dietary approaches to stop hypertension score and presence or absence of coronary heart diseases in patients referring to Imam Hossein Hospital, Tehran, Iran

Zeinab Mokhtarzadeh(1), Javad Nasrollahzadeh(2), Reza Miri(3), Bahram Rashidkhani(4), Saeed Hosseini(5)

Abstract

BACKGROUND: The dietary approaches to stop hypertension (DASH) dietary pattern reduces blood pressure. However, there is little information about the relationship between DASH and coronary heart diseases. This study aimed to assess the relationship between a DASH-style diet adherence score and coronary heart diseases (CHD) in patients referring for coronary angiography.

METHODS: In this study, 201 adults (102 males, 99 females) within the age range of 40-80 years who referred for coronary angiography were selected. Diet was evaluated using a validated food frequency questionnaire. DASH score was calculated based on 8 food components (fruits, vegetables, whole grains, nuts and legumes, low fat dairy, red/processed meats, soft drinks/sweets, and sodium). The relationship between DASH score and CHD was assessed using logistic regression analysis.

RESULTS: Mean of DASH score was 23.99 ± 4.41. Individuals in the highest quartile of DASH score were less likely to have CHD [odds ratio (OR) = 0.38, 95% confidence interval (CI): 0.16-0.86]. However, after adjustment for gender or smoking, there was little evidence that coronary heart disease was associated with DASH diet score. There was a significant negative correlation between DASH score and diastolic blood pressure (P ≤ 0.05).

CONCLUSION: In conclusion, having a diet similar to DASH plan was not independently related to CHD in this study. This might indicate that having a healthy dietary pattern, such as DASH pattern, is highly related to gender (dietary pattern is healthier in women than men) or smoking habit (non-smokers have healthier dietary pattern compared to smokers).

Keywords: Coronary Heart Disease, Dietary Approach to Stop Hypertension, Blood Pressure

Introduction

Coronary heart diseases (CHD) are the main cause of disability and mortality in Iran, since half of annual mortality is due to CHD. The etiology of coronary diseases is largely known and hypertension is its main and independent risk factor. Lifestyle modification is the primary approach to treatment of hypertension and includes dietary changes, weight loss, and physical activity. Diet plays an important role in hypertension. Previous studies have shown the importance of nutrients such as potassium, calcium, and magnesium in blood pressure regulation. However, compared to micronutrient supplementation, changing dietary pattern appears to be more effective in controlling hypertension. Dietary approach to stop hypertension (DASH) is one of the strategies that have been effective in controlling hypertension. In DASH diet,
increased consumption of vegetables, fruits, whole grains, nuts, and low-fat dairy and decreased intake of saturated fatty acids and sugar are encouraged. Several studies have suggested that DASH diet decreases blood pressure, low-density lipoprotein cholesterol (LDL-C), and fasting blood glucose.

Since studying the effect of DASH on cardiovascular events is costly and time consuming, instead of clinical outcomes such as CHD events, most DASH studies have focused on risk factors. However, the relationship between DASH dietary pattern and outcomes of heart diseases could also be investigated through observational studies. Constructing a score which indicates how well an individual follows a diet similar to the DASH plan could be helpful in assessing the relationship between a DASH-style diet and CHD. A study showed that risk of CHD decreased in women, the dietary pattern of whom was similar to DASH pattern. In addition, another study reported that greater concordance with DASH diet guidelines was associated with a somewhat lower incidence of hypertension and mortality due to coronary heart diseases, stroke, or total cardiovascular diseases. However, these relationships were eliminated after adjustment for other risk factors.

The DASH dietary pattern is recommended by the American Heart Association and is included as an example of healthy eating in the 2005 Dietary Guidelines for people. Moreover, no studies have previously investigated the relationship between DASH dietary pattern and coronary artery stenosis in Iran. Therefore, the present work aimed to assess the association between a DASH-style diet adherence score and coronary artery stenosis in patients referring for coronary angiography.

Materials and Methods

Participants

This cross-sectional study was conducted on individuals who referred for coronary angiography to Imam Hossein Hospital in Tehran, Iran, from May 2011 to March 2012. The initial criteria for eligible subjects were age of 40–80 years, no change in diet in the past year, and no history of cancer, kidney, or liver disease. Out of the 215 potential participants, 201 (93.4%) agreed to participate in this study. Moreover, the subjects who reported extremely low or high energy intakes (< 500 or > 5000 kcal/d) were excluded. The final sample consisted of 201 subjects, for whom complete data were available. The ethical committee of Shahid Beheshti University of Medical Sciences approved this study.

Assessment of dietary intake

The patients' dietary intake was assessed through a valid and reliable semi-quantitative food frequency questionnaire (FFQ), which included 168 items of food with standard serving sizes, as commonly consumed by Iranians. Consumption frequency of each food item was questioned on a daily, weekly, or monthly basis and converted to daily intakes; portion sizes were then converted to gram using household measures. The collected data were analyzed using Nutritionist V (First Databank, Hearst Corp., San Bruno, CA, USA). The patients who had incomplete dietary questionnaires were excluded from the study. A DASH score was calculated for each FFQ. DASH score was constructed based on the food and nutrients emphasized or minimized in DASH diet, focusing on 8 components: 1. High intake of fruits (all fruits and fruit juice), 2. Vegetables (all vegetables except potatoes), 3. Low fat dairy products (skimmed milk, yogurt, doogh/yogurt drink, cheese, and kashk (a traditional high protein dairy product)), 4. Whole grains (all whole and dark breads, popcorn, cooked barley, bulgur, and corn), 5. Nuts/legumes (nuts, dried beans, and pear), 6. Low intake of soft drinks and sweets (all soft and sweet, non-alcoholic beer, syrup sugar, cube sugar, noghl (a traditional small white candy), candy, honey, and jams), 7. Red/processed meats (tuna, egg, hamburger, sausage, organ meat, poultry, fish, red meats (beef, and lamb) and 8. Sodium (sum of sodium content of all foods in FFQ).

For calculation, the intake of fruit, vegetable, dairy, bean and nuts, whole grains, red and processed
meat, and soft drinks and sweets was transformed to the servings. Due to the lack of data on the salt intake, only the data on the sodium in foods were used to estimate sodium intake (without considering the received salt). For each 8 components, intake (in serving) was ranked to quintiles.12

For each food group, a maximum score of 5 points could be achieved when the intake met the recommendation, whereas lower intakes were scored proportionately. For the 5 groups of fruit, vegetable, dairy, and beans/nuts minimum intake of quintile received a score of 1 point and maximum intake received a score of 5 points. For the remaining components (red/processed meat, soft drinks/sweets, and sodium) low intake was desirable. Therefore, the lowest quintile received 5 points and the highest was given 1 point. The resulting 8 component scores were summed to create the overall DASH score which could range from 8 to 40.

**Assessment of other variables**

Data on physical activity were obtained using a validated questionnaire and expressed as metabolic equivalents hour/day (METs-h/day), in which 9 different MET levels were ranged on a scale from sleep/rest (0.9 METs) to high-intensity physical activities (> 6 METs).19,20 The MET-time was calculated by multiplying time spent on each activity level by the MET value of each level. Additional covariate information regarding age, smoking habits, medical history, and current use of medications was obtained by questionnaires.

**Statistical analysis**

To determine normality of data distribution, Kolmogorov-Smirnov test was used. Systolic blood pressure and diastolic blood pressure were not normally distributed. Therefore, log transformation was used in statistical tests. Baseline characteristics and components of DASH score were compared between those with and without CHD using t-test for continuous variables and chi-square for dichotomous and categorical variables. DASH score was divided into four ascending categories on an ordinal scale. Mean or prevalence of baseline characteristics was computed for each category. Baseline characteristics were also compared between quartiles of DASH score using ANOVA for continuous variables and chi-square for dichotomous and categorical variables. Dietary intakes of the participants by quartiles of DASH score were analyzed using analysis of covariance (ANCOVA) after being adjusted for age and total energy intake. The relationship between CHD variable and adherence to DASH diet was assessed using multiple regression analysis in different models; controlling for age and energy intake (kcal/day) in model I, for BMI, multivitamin intake, physical activity (MET/day), aspirin use, history of diabetes, hypertension, and hyperlipidemia in model II, and for gender and smoking in model III. Partial correlation was used to assess the relationship between DASH score and blood pressure while controlling for the effects of age and energy intake, BMI, multivitamin use, physical activity, aspirin use, gender, history of diabetes, hypertension, and hyperlipidemia. All the statistical analyses were done in SPSS for Windows (version 19; SPSS Inc., Chicago, IL, USA). Values of P ≤ 0.05 were considered significant.

**Results**

In this study, 102 men and 99 women with the mean age of 59.72 ± 10.43 years participated. Characteristics of the participants by status of CHD are summarized in table 1. Patients with CHD were slightly older, smoked more, and were more likely to have a history of hypertension.

Components of DASH score were not different with or without CHD (Table 2).

Basic characteristics and dietary intakes of the studied participants by quartiles of DASH score are shown in table 3. In the higher quartiles of DASH score, there were more women than men, and more non-smokers than smokers. Furthermore, the subjects in the top quartile of DASH score were less likely to have CHD. The calculated DASH scores for all FFQs ranged from 13 to 34 and the mean DASH score of all the participants was 23.99 ± 4.41. The subjects with higher DASH scores tended to consume more protein, potassium, calcium, and magnesium, but less total energy.

In table 4, odds ratio (OR) is presented for CHD across quartile of DASH score. After adjusting for age, energy intake, BMI, multivitamin use, physical activity, aspirin use, history of diabetes, hypertension, and hyperlipidemia, individuals in the highest quartile of the DASH score were less likely to have CHD [OR = 0.38, 95% Confidence interval (CI): 0.15-0.93; P = 0.05 for trend]. However, when analysis was further adjusted for gender and/or smoking, the trend was not significant.

There was a significant negative correlation (r = -0.13, P = 0.05) between DASH score and diastolic blood pressure, but no such relationship was observed for systolic blood pressure (r = -0.09, P = 0.09). The association was still held even after controlling effect of age, energy intake, BMI, aspirin use, multivitamin use, physical activity, and gender, history of diabetes, hypertension, and hyperlipidemia.
### Table 1. Coronary heart disease (CHD) Risk Factors of study participants according to the status of CHD†

| Variables                      | Without CHD (n = 99)       | With CHD (n = 102)       | P†† |
|--------------------------------|---------------------------|--------------------------|-----|
| Age (year)                     | 58.00 ± 9.80              | 61.39 ± 10.88            | 0.012 |
| BMI (kg/m²)                    | 28.71 ± 5.07              | 27.48 ± 4.33             | 0.062 |
| Systolic blood pressure (mmHg)| 122.71 ± 15.65            | 127.61 ± 20.35           | 0.074 |
| Diastolic blood pressure (mmHg)| 76.56 ± 10.89             | 78.42 ± 11.26            | 0.203 |
| Female                         | 67 (68.3)                 | 29 (28.7)                | 0.001 |
| Current smokers                | 10 (10.9)                 | 25 (24.3)                | 0.015 |
| History of hypertension        | 58 (57.4)                 | 83 (81.5)                | 0.001 |
| History of hyperlipidemia      | 39 (39.6)                 | 52 (50.9)                | 0.124 |
| History of diabetes            | 21 (20.8)                 | 30 (29.6)                | 0.147 |

† Data are presented as mean ± standard deviation or number (%); †† Independent t-test for quantitative variables and chi-square test for qualitative variables; CHD: Coronary heart disease; BMI: Body mass index

### Table 2. Components of dietary approach to stop hypertension (DASH) score according to the status of coronary heart disease (CHD)†

| Variables                      | Without CHD (n = 99)       | With CHD (n = 102)       | P†† |
|--------------------------------|---------------------------|--------------------------|-----|
| Fruit (servings/d)             | 2.28 ± 0.09               | 2.28 ± 0.11              | 0.960 |
| Vegetables (servings/d)        | 2.25 ± 0.10               | 2.23 ± 0.11              | 0.932 |
| Whole grain (servings/d)       | 1.94 ± 0.25               | 1.57 ± 0.20              | 0.265 |
| Nuts and legumes (servings/d)  | 1.54 ± 0.08               | 1.42 ± 0.08              | 0.344 |
| Low-fat dairy (servings/d)     | 1.94 ± 0.08               | 1.80 ± 0.08              | 0.248 |
| Red/processed meats (servings/d)| 0.85 ± 0.04             | 0.95 ± 0.06              | 0.152 |
| Soft drinks/sweets (servings/d)| 2.60 ± 0.23               | 2.77 ± 0.27              | 0.613 |
| Sodium (mg/d)                  | 2174.91 ± 101.42          | 2308.92 ± 113.18         | 0.381 |

† Mean ± SEM (all such values); †† Independent t-test; CHD: Coronary heart disease

### Table 3. Basic characteristics and dietary intakes of study participants by quartiles of dietary approach to stop hypertension (DASH) score†††

| Dietary Intake | Quartiles of DASH score | P for trend††† |
|----------------|--------------------------|---------------|
|                | Q1 (n = 50)              | Q2 (n = 60)   | Q3 (n = 44) | Q4 (n = 47) |               |
| Female/male    |                          | 0.005         | 0.051       | 0.053       | 0.731         |
| Current smokers|                          |               |             |             |               |
| Coronary heart disease |                  |               |             |             |               |
| Multivitamin use |                          |               |             |             |               |
| BMI (kg/m²)    |                          |               |             |             |               |
| Physical activity†††† (MET) |             |               |             |             |               |
| Nutrients†     |                          |               |             |             |               |
| Total energy (kcal/d) | 2333.90 ± 98.27      | 2041.04 ± 89.23 | 2195.74 ± 104.86 | 1999.50 ± 103.17 | < 0.001 |
| Carbohydrate (% of total energy) | 56.00 ± 0.90      | 55.00 ± 0.87 | 53.74 ± 1.00 | 51.81 ± 1.02 | < 0.001 |
| Protein (% of total energy) | 13.10 ± 0.34        | 14.05 ± 0.30 | 14.51 ± 0.36 | 14.71 ± 0.33 | < 0.001 |
| Fat (% of total energy) | 32.20 ± 0.91        | 33.01 ± 0.82 | 33.81 ± 1.01 | 31.48 ± 1.00 | 0.263 |
| Potassium (mg/d) | 2533.14 ± 72.12       | 2955.12 ± 65.72 | 3196.22 ± 76.12 | 3551 ± 75.34 | < 0.001 |
| Calcium (mg/d)   | 951.26 ± 38.36        | 1043.64 ± 34.13 | 1064.09 ± 40.44 | 1191.48 ± 39.63 | < 0.001 |
| Magnesium (mg/d) | 321.11 ± 10.84       | 349.27 ± 9.80 | 367.54 ± 11.42 | 414.58 ± 11.27 | < 0.001 |

†††† Trend P for ANCOVA for quantitative variables and chi-square test for qualitative variables; DASH: Dietary approach to stop hypertension; BMI: Body mass index; MET: metabolic equivalent task; 1 MET: Energy expenditure of sitting quietly or approximately 1 kcal per kg body weight per hour; † Nutrients (except total energy) food intakes were adjusted for age and total energy intake

322 ARYA Atheroscler 2013; Volume 9, Issue 6

www.mui.ac.ir 15 Nov
The rate of coronary heart diseases (CHD) was lower in patients who were at the highest quartile of DASH score (those with a diet most similar to DASH pattern) compared to patients with the lowest quintile score (those with a diet less similar to DASH pattern). However, these relationships were eliminated after adjustment for gender and smoking. Furthermore, DASH score had a reverse correlation with diastolic blood pressure, while no correlation was observed with systolic blood pressure.

A clinical trial showed that DASH diet could reduce systolic blood pressure by 7.7 and diastolic blood pressure by 3.6 mmHg.23 Furthermore, DASH plan might influence other cardiovascular risk factors such as high LDL cholesterol, metabolic syndrome, and inflammation, which could reduce atherosclerosis and CHD.7,12,22 Several studies have shown that having a diet similar to DASH diet in which higher intake of whole grains, vegetables, and fruits are emphasized is associated with lower risk of cardiovascular diseases and stroke.23-25 This decrease in the risk of heart diseases may be related to the micronutrient content of the food recommended in DASH; since higher intake of magnesium, potassium, calcium, and other nutrients like dietary fiber may have a favorable effect on blood pressure, insulin sensitivity, satiety, and BMI.26,27 However, red meat and processed products, which are not recommended in the DASH diet, contain high sodium and saturated fats and could have adverse effects on blood pressure.26,28 In addition, the DASH diet may increase intake of antioxidant and plant compounds with estrogenic activity which could play a role in reduction of cardiovascular diseases.29-32

In this study, when regression analysis was adjusted for gender or smoking, there no longer was a significant relationship between diet and CHD. This might indicate that a healthy diet is highly related to gender or smoking habit. Generally, adherence to the DASH diet in men was significantly lower than that of women in the current study and frequency of CHD was higher in men compared to women. A similar conclusion could also be made in the case of smoking habit. One clear and potentially important difference between this study and some previous studies was that they have examined DASH scores separately in men or women, but this study was conducted on both genders.11,12,23 A similar study showed no correlation between DASH diet and incidence of hypertension and CHD mortality after adjustment for risk factors of CHD.6 However, the results were inconsistent with the study of Fung et al. that observed a significant negative correlation between DASH diet score and incidence of CHD and stroke.12

In this study, adherence to DASH diet in men was significantly less than of women. This difference may be related to the fact that women, compared to men, tend to have a healthier diet. In men, intake of vegetables, fruits, low-fat dairy products, beans, and nuts that increase the DASH diet score was lower, while the intake of red meat/processed products, and sweet drinks which decrease the DASH diet score was higher. Another study reported that, even in similar DASH diet scores, men received more sweet drinks and red meat/processed products than women.33 Another finding was that non-smokers had higher DASH diet scores than smokers. One possible explanation for the low score of smokers might be related to higher consumption of sweets and sweet drinks, since smokers generally consume more sweets than nonsmokers.34,35 DASH score in diabetics was higher than that of non-diabetics, which was consistent with a national study conducted in the United States of America, showing that, the diet of diabetics had more similarities to the DASH plan...

---

**Table 4.** Multivariate adjusted odds for coronary heart disease (CHD) across quartiles of dietary approaches to stop hypertension (DASH) score

| CHD     | Q1 (n = 50) | Q2 (n = 60) | Q3 (n = 44) | Q4 (n = 47) | P for trend |
|---------|-------------|-------------|-------------|-------------|------------|
| Crude   | 1.00        | 0.52 (0.24-1.13) | 0.56 (0.24-1.18) | 0.38 (0.16-0.86) | 0.032      |
| Model I††| 1.00        | 0.52 (0.23-1.11) | 0.54 (0.23-1.27) | 0.36 (0.15-0.86) | 0.036      |
| Model II†| 1.00        | 0.51 (0.22-1.12) | 0.55 (0.23-1.13) | 0.38 (0.15-0.93) | 0.051      |
| Model III‡‡| 1.00        | 0.54 (0.21-1.39) | 0.66 (0.24-1.70) | 0.42 (0.15-1.20) | 0.085      |

DASH: Dietary approaches to stop hypertension; BMI: Body mass index; Values are odds ratio (OR) with 95% of confidence interval (CI); † Model I: Adjusted for age and energy intake; †† Model II: Additionally adjusted for BMI, multivitamin use, physical activity and aspirin use, history of diabetes, hypertension and hyperlipidemia; ‡‡ Model III: Further adjusted for gender and smoking

---

**Discussion**

This study showed that a diet that was more similar to the DASH diet was associated with lower CHD. The rate of coronary heart diseases (CHD) was lower in patients who were at the highest quartile of DASH score (those with a diet most similar to DASH pattern) compared to patients with the lowest quintile score (those with a diet less similar to DASH pattern). However, these relationships were eliminated after adjustment for gender and smoking. Furthermore, DASH score had a reverse correlation with diastolic blood pressure, while no correlation was observed with systolic blood pressure.

A clinical trial showed that DASH diet could reduce systolic blood pressure by 7.7 and diastolic blood pressure by 3.6 mmHg.23 Furthermore, DASH plan might influence other cardiovascular risk factors such as high LDL cholesterol, metabolic syndrome, and inflammation, which could reduce atherosclerosis and CHD.7,12,22 Several studies have shown that having a diet similar to DASH diet in which higher intake of whole grains, vegetables, and fruits are emphasized is associated with lower risk of cardiovascular diseases and stroke.23-25 This decrease in the risk of heart diseases may be related to the micronutrient content of the food recommended in DASH; since higher intake of magnesium, potassium, calcium, and other nutrients like dietary fiber may have a favorable effect on blood pressure, insulin sensitivity, satiety, and BMI.26,27 However, red meat and processed products, which are not recommended in the DASH diet, contain high sodium and saturated fats and could have adverse effects on blood pressure.26,28 In addition, the DASH diet may increase intake of antioxidant and plant compounds with estrogenic activity which could play a role in reduction of cardiovascular diseases.29-32
than that of non-diabetics. One limitation of this study was that the present study’s FFQ was not designed to precisely estimate sodium intake. Given that the amount of sodium intake cannot be accurately estimated through FFQs, by using the quintile approach the probability of misclassifying the participants’ DASH score would decrease. Another limitation of this study was its cross-sectional design, since a cohort design was more appropriate.

In conclusion, following a diet similar to the DASH plan was not independently associated with coronary heart diseases in this study. This might indicate that having a healthy dietary pattern such as DASH pattern is highly related to gender (dietary pattern is healthier in women than men) or smoking habit (non-smokers have healthier dietary pattern compared to smokers). With respect to the role of DASH diet in reducing cardiovascular risk factors and events, it is appropriate to provide approaches for encouraging people with high risk of CHD to take this diet.

Acknowledgments
The authors thank all the patients who participated in or collaborated with the current study.

Conflict of Interests
Authors have no conflict of interests.

References
1. Hatmi ZN, Tahvildari S, Gafarzadeh MA, Sabouri KA. Prevalence of coronary artery disease risk factors in Iran: a population based survey. BMC Cardiovasc Disord 2007; 7: 32.
2. Lenfant C, Chobanian AV, Jones DW, Roccella EJ. Seventh report of the Joint National Committee on the Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7): resetting the hypertension sails. Hypertension 2003; 41(6): 1178-9.
3. Sacks FM, Campos H. Dietary therapy in hypertension. N Engl J Med 2010; 362(22): 2102-12.
4. Houston MC, Harper KJ. Potassium, magnesium, and calcium: their role in both the cause and treatment of hypertension. J Clin Hypertens (Greenwich) 2008; 10(7 Suppl 2): 3-11.
5. Harnden KE, Frayn KN, Hodson L. Dietary Approaches to Stop Hypertension (DASH) diet: applicability and acceptability to a UK population. J Hum Nutr Diet 2010; 23(1): 3-10.
6. Folsoom AR, Parker ED, Harnack LJ. Degree of concordance with DASH diet guidelines and incidence of hypertension and fatal cardiovascular disease. Am J Hypertens 2007; 20(3): 225-32.
7. Al-Solaiman Y, Jesri A, Mountford WK, Lackland DT, Zhao Y, Egan BM. DASH lowers blood pressure in obese hypertensives beyond potassium, magnesium and fibre. J Hum Hypertens 2010; 24(4): 237-46.
8. Ebarzanez E, Sacks FM, Vollmer WM, Bray GA, Miller ER, Lin PH, et al. Effects on blood lipids of a blood pressure-lowering diet: the Dietary Approaches to Stop Hypertension (DASH) Trial. Am J Clin Nutr 2001; 74(1): 80-9.
9. Ard JD, Grambow SC, Liu D, Slentz CA, Kraus WE, Svetkey LP. The effect of the PREMIER interventions on insulin sensitivity. Diabetes Care 2004; 27(2): 340-7.
10. Chen ST, Maruthur NM, Appel LJ. The effect of dietary patterns on estimated coronary heart disease risk: results from the Dietary Approaches to Stop Hypertension (DASH) trial. Circ Cardiovasc Qual Outcomes 2010; 3(5): 484-9.
11. Levitan EB, Wolk A, Mittleman MA. Consistency with the DASH diet and incidence of heart failure. Arch Intern Med 2009; 169(9): 851-7.
12. Fung TT, Chiuve SE, McCullough ML, Rexrode KM, Logroscino G, Hu FB. Adherence to a DASH-style diet and risk of coronary heart disease and stroke in women. Arch Intern Med 2008; 168(7): 713-20.
13. Lichtenstein AH, Appel LJ, Brands M, Carnethon M, Daniels S, Franch HA, et al. Diet and lifestyle recommendations revision 2006: a scientific statement from the American Heart Association Nutrition Committee. Circulation 2006; 114(1): 82-96.
14. United States Department of Health and Human Services, United States Office of Disease Prevention and Health Promotion. A healthier you: based on the Dietary guidelines for Americans. Washington, DC: U.S. Dept of Health and Human Services, Office of Disease Prevention and Health Promotion; 2005.
15. Jaceeldo-Sieg K, Knutsen SF, Sabate J, Beeson WL, Chan J, Herring RP, et al. Validation of nutrient intake using an FFQ and repeated 24 h recalls in black and white subjects of the Adventist Health Study-2 (AHS-2). Public Health Nutr 2010; 13(6): 812-9.
16. Libby P, Bonow PO, Zipes DP, Mann DL. Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine. 8th ed. Philadelphia, PA: Elsevier - Health Sciences Division; 2007.
17. 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.
18. Ghaffarpour M, Hooshvar Rad A, Kianfar H. The manual for household measures, cooking yields
factors and edible portion of foods. Tehran, Iran: Publication of Agricultural Sciences; 1999. [In Persian].

19. Aadahl M, Jorgensen T. Validation of a new self-report instrument for measuring physical activity. Med Sci Sports Exerc 2003; 35(7): 1196-202.

20. Norman A, Bellocco R, Bergstrom A, Wolk A. Validity and reproducibility of self-reported total physical activity-differences by relative weight. Int J Obes Relat Metab Disord 2001; 25(5): 682-8.

21. Blumenthal JA, Babyak MA, Hinderliter A, Watkins LL, Craighead L, Lin PH, et al. Effects of the DASH diet alone and in combination with exercise and weight loss on blood pressure and cardiovascular biomarkers in men and women with high blood pressure: the ENCORE study. Arch Intern Med 2010; 170(2): 126-35.

22. Azadbakht L, Mirmiran P, Esmaillzadeh A, Azizi T, Azizi F. Beneficial effects of a Dietary Approaches to Stop Hypertension eating plan on features of the metabolic syndrome. Diabetes Care 2005; 28(12): 2823-31.

23. Fung TT, Stampfer MJ, Manson JE, Rexrode KM, Willett WC, Hu FB. Prospective study of major dietary patterns and stroke risk in women. Stroke 2004; 35(9): 2014-9.

24. Fung TT, Willett WC, Stampfer MJ, Manson JE, Hu FB. Dietary patterns and the risk of coronary heart disease in women. Arch Intern Med 2001; 161(15): 1857-62.

25. McCullough ML, Feskanich D, Stampfer MJ, Giovannucci EL, Rimm EB, Hu FB, et al. Diet quality and major chronic disease risk in men and women: moving toward improved dietary guidance. Am J Clin Nutr 2002; 76(6): 1261-71.

26. Steffen LM, Kroenke CH, Yu X, Pereira MA, Slattery ML, Van HL, et al. Associations of plant food, dairy product, and meat intakes with 15-y incidence of elevated blood pressure in young black and white adults: the Coronary Artery Risk Development in Young Adults (CARDIA) Study. Am J Clin Nutr 2005; 82(6): 1169-77.

27. Steffen LM, Jacobs DR, Jr., Murtaugh MA, Moran A, Steinberger J, Hong CP, et al. Whole grain intake is associated with lower body mass and greater insulin sensitivity among adolescents. Am J Epidemiol 2003; 158(3): 243-50.

28. Elliott P, Kesteloot H, Appel LJ, Dyer AR, Ueshima H, Chan Q, et al. Dietary phosphorus and blood pressure: international study of macro- and micro-nutrients and blood pressure. Hypertension 2008; 51(3): 669-75.

29. Lopes HF, Martin KL, Nashar K, Morrow JD, Goodfriend TL, Egan BM. DASH diet lowers blood pressure and lipid-induced oxidative stress in obesity. Hypertension 2003; 41(3): 422-30.

30. Konhias JP, Leinwald LA. The effects of biological sex and diet on the development of heart failure. Circulation 2007; 116(23): 2747-59.

31. Most MM. Estimated phytochemical content of the dietary approaches to stop hypertension (DASH) diet is higher than in the Control Study Diet. J Am Diet Assoc 2004; 104(11): 1725-7.

32. Ye Z, Song H. Antioxidant vitamins intake and the risk of coronary heart disease: meta-analysis of cohort studies. Eur J Cardiovasc Prev Rehabil 2008; 15(1): 26-34.

33. Levitan EB, Wolk A, Mittleman MA. Relation of consistency with the dietary approaches to stop hypertension diet and incidence of heart failure in men aged 45 to 79 years. Am J Cardiol 2009; 104(10): 1416-20.

34. Pepino MY, Mennella JA. Effects of cigarette smoking and family history of alcoholism on sweet taste perception and food cravings in women. Alcohol Clin Exp Res 2007; 31(11): 1891-9.

35. Palaniappan U, Jacobs SL, O'Loughlin J, Gray-Donald K. Fruit and vegetable consumption is lower and saturated fat intake is higher among Canadians reporting smoking. J Nutr 2001; 131(7): 1952-8.

36. Mellen PB, Gao SK, Vitolins MZ, Goff DC. Deteriorating dietary habits among adults with hypertension: DASH dietary accordance, NHANES 1988-1994 and 1999-2004. Arch Intern Med 2008; 168(3): 308-14.

How to cite this article: Mokhtari Z, Nasrollahzadeh J, Mirmiran P, Esmaillzadeh A, Azizi T, Azizi F. Relationship between dietary approaches to stop hypertension score and presence or absence of coronary heart diseases in patients referring to Imam Hossein Hospital, Tehran, Iran. ARYA Atheroscler 2013; 9(6): 319-25.