Demographic and socioeconomic differences in fruit and vegetables consumption, 2007-2009: a province-level study in iran.

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Demographic and Socioeconomic Differences in Fruit and Vegetables Consumption, 2007-2009: A Province-Level Study in Iran

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ABSTRACT

Background: High daily intake of fruit and vegetables promotes population health and is inversely associated with morbidity and mortality. Demographic and socioeconomic characteristics are among main predictors of fruit and vegetables consumption. The current study aimed to evaluate these associations using province-level data in Iran during the years 2007-2009.

Methods: Data on the mean number of fruit and vegetables consumption per day in age and sex stratum at the province level from three consecutive stepwise non-communicable diseases risk factors surveys were obtained. Data about provinces' socioeconomic status (SES) were obtained from the Statistical Centre of Iran and published reports. One-way repeated measures ANOVA and random effect linear regression models were applied for non-stratified and stratified analyses, respectively.

Results: There were substantial variations in the fruit and vegetables consumption across the country. Consumption of vegetables was higher than fruit over the study period. There were no statistically significant differences in fruit ($P = 0.52$) and vegetables ($P = 0.14$) intake among men and women. Older age was associated with lower consumption of fruit. People in the provinces with better SES consumed higher amounts of combined fruit and vegetables and this association was more profound among females.

Conclusions: The results suggest that policies and interventions to improve the intake of fruit and vegetables in the country may be significantly beneficial, especially for older people and women in low socioeconomic groups.

Keywords: Fruit, human development index, Iran, socioeconomic, vegetables

Original Article

INTRODUCTION

Previous studies have shown that there is an association between dietary patterns and risk of many diseases.[1-5] As a main component of human nutrition, fruit and vegetables play an important role in association among dietary pattern and risk of diseases. Some recent systematic reviews reported that a

high daily intake of fruit and vegetables promotes population health and is inversely associated with cardiovascular disease incidence and mortality.[6,7]

Furthermore, previous systematic reviews have shown the positive impact of fruit and vegetables intake on reducing the risk of gastric cancer,[8] obesity,[9] type 2 diabetes.[10] It is estimated that around 2.7 million deaths per year are attributable to inadequate intake of fruit and vegetables worldwide.[11] These associations have urged health authorities to include some recommendations on consumption of fruit and vegetables in their guidelines and policies. For example, US health authorities recommend daily consumption of a minimum 5 fruit and vegetables servings,[12] and World Health Organization (WHO) recommends a daily intake of at least 400 gm fruit and vegetables.[13]

Previous studies in Iran have reported that consumption of fruit and vegetables among Iranian population are lower than international recommendations.[14-17] On the other hand, studies have found that the consumption of fruit and vegetables is associated with lower risk of the metabolic syndrome, obesity and cardiovascular disease among the Iranian population.[18-20] These evidence suggest the necessity of developing specific plans to increase fruit and vegetables intake in the country. To do this, examining the determinants of fruit and vegetables consumption and identifying the groups with higher need of improvement is a first step. Most previous studies, which have been done in developed countries, have shown that gender, race and ethnicity, resident area, occupation, individual socioeconomic status (SES) and neighborhood SES are some of the main predictors of fruit and vegetables consumption.[21-23] A previous study in Iran showed that low education and low income were associated with lower consumption of fruit and vegetables among elderly people.[24] It seems that less attention has been given to the socioeconomic predictors of fruit and vegetables intake and most studies just described the level of consumption in the country. To fill the knowledge gap in this area, the current study was conducted to examine the demographic and socioeconomic predictors of fruit and vegetables intake using province-level data from stepwise non-communicable diseases risk factors surveys over 2007-09 in Iran (Iran-STEPs).

METHODS

Data sources

Following recommendation by WHO, Iran STEPs was launched as a nationwide system, covering all provinces, in 2005.[25] Since then, this survey has been conducted every year in the country. In summary, a representative sample (30,000 participants) of 15-64 years old population is selected using multi-stage cluster sampling method. Sampling frame was defined in 50 clusters for every 30 provinces. Each cluster was selected based on random cluster sampling including 20 persons (10 males and 10 females) in each age group.[26] Then these people were interviewed to get update information on demographic and behavioral risk factors including tobacco use, diet, physical activity, history of high blood pressure, diabetes (For more detailed information see.[17,26,27]).

In the current study, we used the publicly available data on the mean number of fruit and vegetables consumption per day in age (five groups including 15-24, 25-34, 35-44, 45-54 and 55-64 years old) and sex stratum in the province level from Iran STEPs for years 2007-09.[27] People were asked how often they consumed fruit and vegetables in a typical week, and the average of consumption on one of those days.[26] Data on provinces unemployment and urbanization rates were obtained from the statistical centre of Iran.[28] Data on the provinces human development index (HDI),[29] were obtained from a published report.[30]

Variables

Mean number size of fruit and vegetables per day were used as dependent variables. These variables were calculated by multiplying the number of days that a person consumes the fruit or vegetables by the average number of serving in one of those days.[17] A serving size was defined as 80 gm of fruit or vegetables (for more detail information see,[17]). The demographic characteristics of participants and SES of the provinces were used as explanatory variables.

Three variables were used as proxy of provinces SES including unemployment rate, the proportion of population living at urban areas (urbanization) and HDI.

The gender and age were considered as demographic variables. For HDI where annual data

for study period was available, the updated yearly values were used in the models. For unemployment rate and urbanization, the latest available data from 2006 census,[28] were used in the models.

Statistical analysis

As data were reported in the stratum of age and sex, two types of analyses were conducted in the study: Non-stratified and stratified analysis. In the non-stratified analysis, the age and sex weighted mean of fruit and vegetables consumption were calculated for each province for the years 2007-09. To calculate the weighted mean, the proportion of each age and gender stratum in the provinces were extracted from the Iran's 2006 national census estimates.[28] In addition, the provinces were divided in four quartiles of HDI. Then, one-way repeated measures ANOVA was used to compare the mean of fruit and vegetables among age, sex and HDI groups.

In the stratified analysis, first 10 strata were created based on age and gender stratum (90 observations in each stratum). Then, random effect linear regression model,[31] was used to model the data in each stratum. Separate models were applied for fruit, vegetables and combination of both.

The standard errors were corrected for clustering of the estimates reported from the same province and heteroskedasticity.[32] The mean centering values of the continuous covariates were used in the regression analysis. The STATA version 11,[33] was used for the statistical analyses.

RESULTS

Data in Table 1 show the weighted average of fruit and vegetables consumption per day in the provinces of Iran over 2007-09. It can be seen that there were substantial variations in the fruit and vegetables consumption across the country. Women in Semnan and Northern Khorasan provinces had highest and lowest daily consumption of fruit, respectively (2.80-fold difference). Men in Semnan and Southern Khorasan provinces had highest and lowest daily consumption of fruit, respectively (2.65-fold difference). Highest and lowest daily consumption of vegetables happened in the Bushehr and Chaharmahal Bakhtiari provinces for both sex (3.49 and 3.74-fold differences among women and men, respectively). Only in 6 out of 30 provinces, men had higher consumption of fruit than women. This figure for consuming vegetables was only 2 out of 30 provinces. In most provinces, consumption of vegetables was higher than fruit over the study period.

Figures 1-3 show the scatterplots between provinces' SES variables and combined fruit and

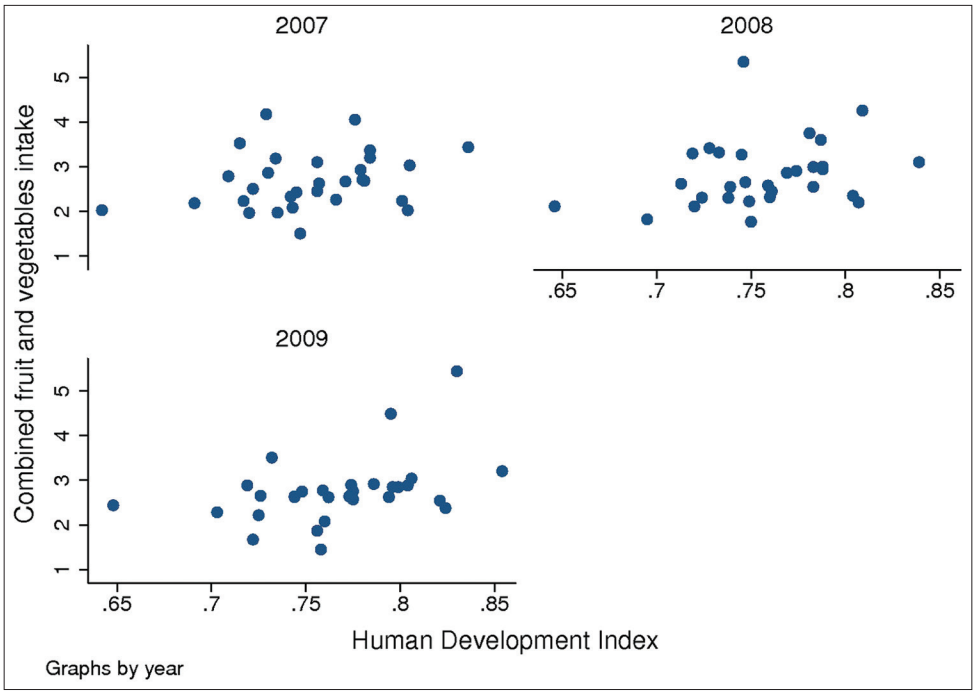

Figure 1: Scatter plot of association between human development index and combined daily fruit and vegetables intake

Table 1: Weighted mean (CI) of daily consumption of fruit and vegetables in provinces during 2007-2009

Province	Fruit		Vegetables	
	Female	Male	Female	Male
East Azerbaijan	1.32 (1.21-1.43)	1.26 (1.12-140)	1.63 (1.50-1.77)	1.51 (1.41-1.61)
West Azerbaijan	1.27 (1.18-1.36)	1.23 (1.15-1.31)	1.66 (1.57-1.75)	1.37 (1.21-1.54)
Ardebil	1.59 (1.38-1.79)	1.43 (1.14-1.73)	1.93 (1.77-2.09)	1.82 (1.50-2.13)
Isfahan	1.33 (1.21-1.45)	1.24 (1.11-1.37)	1.04 (0.96-1.13)	0.91 (0.84-0.98)
Ilam	1.36 (1.17-1.55)	1.16 (1.05-1.27)	1.93 (1.61-2.25)	1.84 (1.64-2.03)
Bushehr	1.79 (1.64-1.93)	1.59 (1.39-1.79)	2.58 (2.37-2.79)	2.28 (2.14-2.42)
Tehran	1.79 (1.65-1.92)	1.68 (1.51-1.85)	1.58 (1.51-1.65)	1.46 (1.34-1.58)
Chaharmahal Bakhtiari	0.99 (0.97-1.07)	0.80 (0.72-0.87)	0.74 (0.66-0.83)	0.61 (0.55-0.68)
Razavi Khorasan	1.15 (1.01-1.28)	1.01 (0.94-1.09)	1.64 (1.51-1.78)	1.34 (1.22-1.45)
Khuzestan	1.22 (1.13-1.30)	1.30 (1.16-1.44)	1.64 (1.56-1.73)	1.56 (1.42-1.70)
Zanjan	1.21 (1.09-1.33)	1.15 (1.06-1.23)	1.26 (1.14-1.39)	1.23 (1.12-1.33)
Semnan	2.46 (2.07-2.84)	2.25 (1.95-2.54)	2.12 (1.73-2.52)	1.68 (1.38-1.98)
Sistan and Baluchestan	1.05 (0.97-1.14)	1.02 (0.95-1.08)	1.11 (0.92-1.31)	1.21 (1.14-1.27)
Fras	1.34 (1.27-1.40)	1.34 (1.26-1.42)	1.45 (1.33-1.56)	1.28 (1.18-1.39)
Qazvin	1.89 (1.67-2.11)	1.66 (1.43-1.88)	1.54 (1.44-1.63)	1.36 (1.27-1.44)
Qom	1.60 (1.42-1.78)	1.61 (1.45-1.78)	1.23 (1.11-1.35)	1.26 (1.18-1.35)
Kordestan	1.06 (1.00-1.13)	1.20 (1.03-1.36)	0.97 (0.86-1.07)	0.97 (0.82-1.12)
Kerman	1.54 (1.04-2.03)	1.52 (1.07-1.98)	1.71 (1.17-2.25)	1.60 (0.99-2.21)
Kermanshah	1.22 (1.10-1.35)	1.20 (1.11-1.29)	1.09 (0.93-1.25)	1.03 (0.91-1.16)
Kohkilooyeh and Boyer Ahmad	1.14 (1.03-1.25)	1.27 (1.15-1.40)	1.86 (1.73-1.99)	1.66 (1.51-1.81)
Golestan	1.24 (1.13-1.35)	1.18 (1.09-1.27)	1.27 (1.06-1.47)	1.07 (0.93-1.22)
Gilan	1.43 (1.26-1.59)	1.34 (1.19-1.48)	1.20 (1.11-1.29)	1.17 (1.12-1.22)
Lorestan	1.41 (1.24-1.59)	1.36 (1.24-1.49)	1.83 (1.66-2.01)	1.71 (1.58-1.84)
Mazandaran	1.53 (1.41-1.64)	1.51 (1.42-1.59)	1.38 (1.31-1.45)	1.25 (1.19-1.31)
Markazi	1.59 (1.45-1.73)	1.63 (1.53-1.74)	1.52 (1.42-1.62)	1.50 (1.41-1.58)
Hormozgan	1.25 (1.08-1.42)	1.22 (1.15-1.30)	1.33 (1.15-1.50)	1.23 (1.14-1.32)
Hamedan	1.20 (1.11-1.29)	1.20 (1.04-1.36)	1.70 (1.46-1.93)	1.39 (1.28-1.50)
Yazd	1.26 (1.18-1.33)	1.38 (1.30-1.45)	1.04 (0.97-1.11)	0.96 (0.89-1.04)
Southern Khorasan	0.93 (0.84-1.02)	0.85 (0.78-0.91)	1.46 (1.36-1.55)	1.10 (0.99-1.21)
Northern Khorasan	0.88 (0.79-0.96)	0.85 (0.77-0.93)	1.21 (1.08-1.33)	1.07 (0.99-1.15)
Total	1.37 (1.33-1.41)	1.32 (1.28-1.37)	1.49 (1.44-1.54)	1.35 (1.31-1.40)

vegetables intake. It can be seen that generally better SES was positively associated with higher consumption of fruit and vegetables.

The average daily consumption of fruit and vegetables by HDI quartiles has been shown in Figures 4 and 5, respectively. A clear gradient between HDI level and fruit consumption was observed, but it was not the case in the vegetables consumption.

The results of one-way repeated measures ANOVA indicated that there were no significant differences in the daily consumption of fruit ($P = 0.52$) and vegetables ($P = 0.14$) between men and women. In terms of age group, the daily consumption of fruit was significantly different among age groups ($P < 0.01$) and older age was associated with lower consumption. However, this difference was not significant in the vegetables consumption ($P = 0.90$). In addition, the results showed a significant difference in fruit consumption among HDI quartiles ($P < 0.01$), but no significant difference in vegetables intake ($P = 0.81$).

Table 2 presents the results of regression analysis for males. Generally, higher HDI was associated with higher consumption of fruit but not vegetables. When the combined consumption of fruit and vegetables was considered, this association was significant only among 15-24 and 45-54 years old groups. Higher rate of urbanization in a province was related to higher

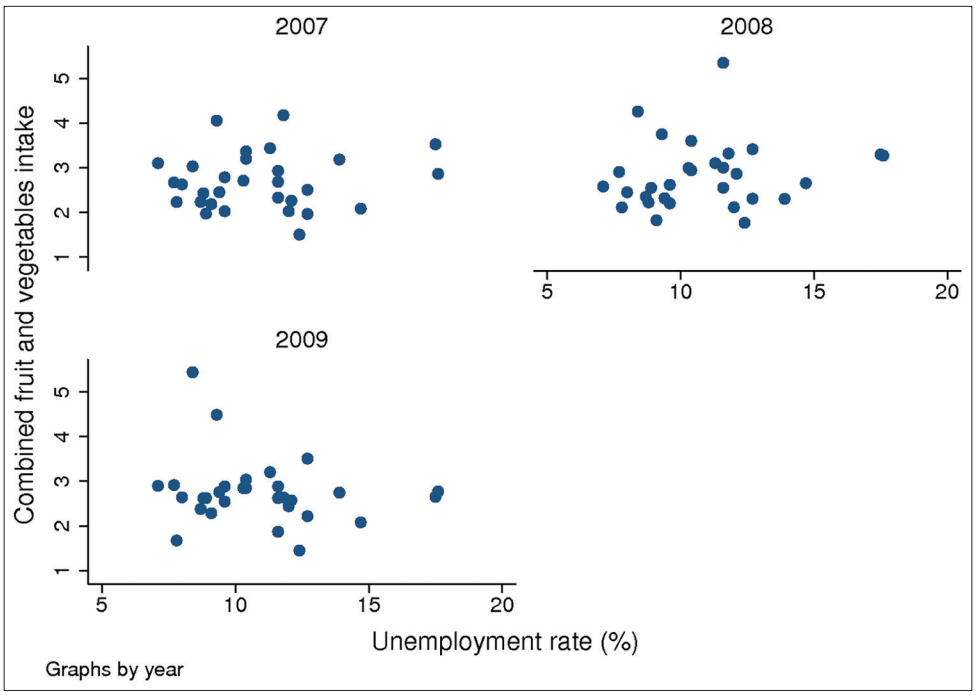

Figure 2: Scatter plot of association between unemployment rate and combined daily fruit and vegetables intake

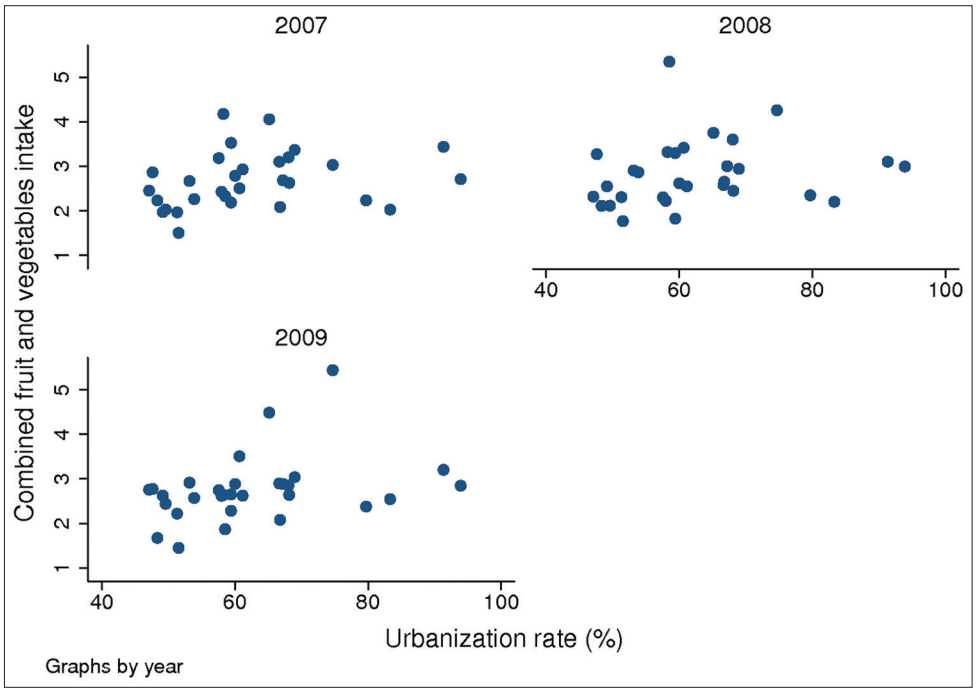

Figure 3: Scatter plot of association between urbanization rate and combined daily fruit and vegetables intake

consumption of fruits in the youngest and oldest age groups. On average, males consumed less fruit in year 2009 than year 2007. Comparing the constant term (which shows the average consumption for the provinces with mean value of covariates) reveals that older age was associated with lower consumption of fruits. There was no significant association between socioeconomic characteristics of a province and the vegetables consumption among males. On average, the oldest age group had the lowest vegetables consumption in the provinces.

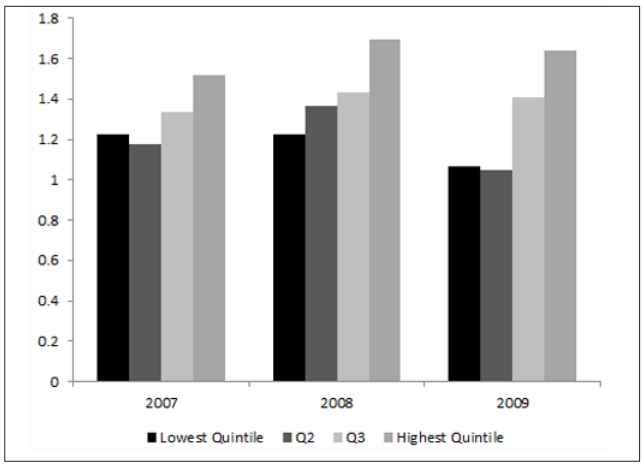

Figure 4: Mean of daily fruit consumption by human development index quartiles in Iran, 2007-2009

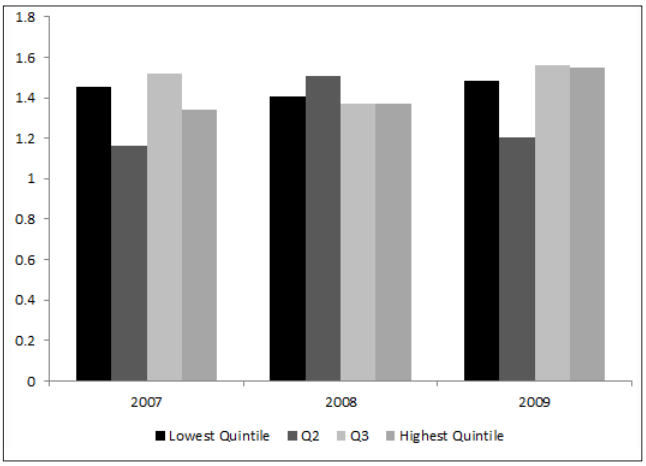

Figure 5: Mean of daily vegetables consumption by human development index quartiles in Iran, 2007-2009

Table 2: Results of random effect linear regression model for males

	Age groups				
	15-24	**25-34**	**35-44**	**45-54**	**55-64**
Fruit					
HDI	3.805***	3.234**	3.094**	3.748**	1.965
Urbanization	0.742**	0.533	0.426	0.268	0.628**
Unemployment	0.002	0.014	–0.001	0.003	–0.004
Year[a]					
2008	0.033	0.028	0.040	0.093	0.076
2009	–0.157**	–0.135*	–0.137**	–0.091	–0.139**
Constant	1.421***	1.384***	1.310***	1.204***	1.149***
Vegetables					
HDI	1.012	1.308	2.314	2.060	1.141
Urbanization	0.184	–0.051	–0.205	–0.235	0.031
Unemployment	0.029*	0.031	0.026	0.023	0.021
Year[a]					
2008	0.053	–0.023	0.063	–0.043	–0.009
2009	0.024	0.007	0.072	–0.041	0.013
Constant	1.313***	1.355***	1.312***	1.417***	1.304***
Fruit and vegetables (combined)					
HDI	4.777**	4.447	5.304*	5.736**	3.052
Urbanization	0.935	0.502	0.244	0.049	0.670
Unemployment	0.031	0.045	0.024	0.026	0.018
Year[a]					
2008	0.087	0.006	0.103	0.051	0.067
2009	–0.132	–0.126	–0.063	–0.130	–0.125
Constant	2.734***	2.739***	2.621***	2.621***	2.453***

***,**,*Indicate 1,5 and 10% significant level, respectively, [a]Year 2007 used as reference year; HDI=Human development index

Table 3 presents the results of the regression analysis among females. It can be seen that higher value of HDI was associated with higher consumption of fruits. This association was not statistically significant for the vegetables consumption. When combined consumption of fruit and vegetables was used as dependent variable, we found that there was a positive

Table 3: Results of random effect linear regression model for females

	Age groups				
	15-24	**25-34**	**35-44**	**45-54**	**55-64**
Fruit					
HDI	4.479***	3.967***	4.404***	3.598*	3.514**
Urbanization	0.473	0.404	0.367	0.343	0.374
Unemployment	0.003	–0.000	–0.001	–0.004	–0.003
Year[a]					
2008	0.148*	0.144**	0.127	0.148**	0.185***
2009	–0.040	–0.065	0.001	0.034	0.038
Constant	1.406***	1.389***	1.292***	1.160***	1.056***
Vegetables					
HDI	2.314	2.635	3.037	4.413*	3.661*
Urbanization	–0.283	–0.455	–0.323	–0.609	–0.498
Unemployment	0.032	0.025	0.027	0.023	0.013
Year[a]					
2008	–0.004	0.066	0.056	0.037	0.112
2009	0.073	0.100	0.083	0.085	0.138
Constant	1.442***	1.450***	1.486***	1.459***	1.330***
Fruit and vegetables (combined)					
HDI	6.753**	6.643**	7.421**	7.893**	7.131**
Urbanization	0.199	–0.060	0.048	–0.241	–0.114
Unemployment	0.034	0.025	0.026	0.020	0.010
Year[a]					
2008	0.144	0.210	0.183	0.186	0.298*
2009	0.034	0.034	0.084	0.121	0.176
Constant	2.847***	2.840***	2.778***	2.618***	2.386***

***,**,*Indicate 1,5 and 10 percent significant level, respectively; [a]Year 2007 used as reference; HDI=Human development index

significant association between province›s HDI and the consumption of fruit and vegetables. On average, females consumed more fruit in year 2008 than year 2007. Consumption of fruit was lower among older age groups than younger groups. On the other hand, women in 35-44 years age group had the highest consumption of vegetables in the country during the study period [Table 3].

DISCUSSION

In the current study, using available data at the province level from the national surveys, the association between socioeconomic status and fruit and vegetables consumption was examined in the 30 provinces of Iran. The results showed that in general, the provinces with better SES had higher consumption of combined fruit and vegetables and this association was more profound among females. Moreover, older age was associated with lower consumption of fruit in the country. In most provinces, females had higher consumption of fruit and vegetables than males, but these differences were not statistically significant.

Previous national and international studies have shown inconsistence results on the effect of age and gender on the fruit and vegetables consumption. Esteghamati *et al*.[17] using individual level data on third Iranian STEPs, reported that while there was a linear trend toward low fruit consumption in older age, there were no significant differences in vegetables consumption among age groups. In addition, they found a higher consumption of vegetables among females, but no significant difference in fruit consumption between males and females. In the other study, Mohammadifard *et al*.[34] reported a higher consumption of fruit and vegetables among males. The findings of the current study are in the line with Esteghamati *et al*.[17] as data for both studies come from Iranian STEPs.

The analysis of data from the World Health Survey showed that the prevalence of low fruit and vegetables consumption tend to increase with age.[35] On the other hand, they found that gender difference in likelihood of low fruit and vegetables intake was presented only in 15 out of 52 countries. In other study, Tamers *et al*.[36] found that older people in United State and France had higher frequency of consumption than younger population.

The positive observed association between combined fruit and vegetables consumption and SES in the current study is in line with the previous studies.[22-25,35,37-40] A pooled analysis of survey data in 11 European countries showed that a higher SES was associated with a greater consumption of both fruit and vegetables.[40] Moreover, we found that SES had a more profound impact on the fruit and vegetables consumption among females than males. This finding implies that women with low SES would be mostly affected by changes in the price of fruit and vegetables.

When fruit and vegetables were analyzed separately, the results showed that the association between vegetables consumption and SES was not statistically significant. The higher price of fruit in the country may partly explain this finding. Moreover, this implies that promotion of the SES may result in larger increase in fruit than vegetables intake.

The results of the current study should be interpreted considering some limitations. Firstly, the data from census and surveys are subject to incompleteness and measurement errors which may bias the results. Secondly, the data used in the study are aggregated data at the province level. This makes it impossible to draw any causal interpretation from the results. Moreover, it limits the generalizability of our findings to other level and settings. Thirdly, while we used the data on the fruit and vegetables consumption for ten strata in each province, the same value of SES was used for these strata which cannot capture the differences in SES among the age and sex groups. These limitations may dealt with in a future study using individual level data on fruit and vegetables consumption and individual- and area-level data on the SES.

CONCLUSIONS

The results of current study revealed the significant variations in consumption of fruit and vegetables between gender, age and socioeconomic groups among the provinces in Iran. Results showed that younger people in provinces with better SES consumed more fruit and vegetables than other people. Moreover, socioeconomic differences in consumption of fruit and vegetables were more profound among women. The results suggest that policies and interventions to improve the intake of fruit and vegetables in the country may be significantly beneficial, especially for older people and women in low socioeconomic groups.

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