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Original Article

Socioeconomic Status and Changes in Iranian Household Food Basket Using National Household Budget and Expenditure Survey Data, 1991-2017

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Abstract

Background: Socioeconomic factors are major determinants of health and food consumption. The aim of the present study was assessing the changes in energy and different food groups consumption related to the socioeconomic status of Iranian households.

Methods: In this repeated cross-sectional study, 717432 households data from the Households Income and Expenditure Survey (HIES) conducted yearly by the Statistical Centre of Iran (SCI) from 1991 to 2017 was used. The food consumption outcome was modeled as a function of household head age, household head age-squared, socioeconomic variables, household size, place of residence, and household`s head sex. Principle Component Analysis (PCA) was used to extract a socioeconomic status variable based on the educational, occupational, and income status of households. A cross-classified random effects modeling (CCREM) specifications of Hierarchical Age-Period-Cohort (HAPC) models was used in the present study.

Results: In the present study, by moving to the higher quartiles of SES had higher calorie intake increased. There was a positive relationship between "Vegetables", "Fruits", "Dairy", "Meat, Poultry, Fish, Eggs, Legumes, and Nuts" and "Fats, Oils, Sugars, and Sweets" with socioeconomic statues category. In the case of "Bread, Cereal, Rice, and Pasta", there was a reverse relationship, and lower SES quartile consumed a higher amount of this food group.

Conclusion: Lower income, education, and occupational status in lower SES quartile groups lead to lower calorie consumption and higher consumption of "Bread, Cereal, Rice, and Pasta" food group, which had lower energy cost compared to the other food groups.

Keywords: Food consumption; Socioeconomic status; Age-period-cohort model; Iran

Introduction

The dietary intakes and the eating patterns, both in terms of quality and quantity, in the low- and middle-income countries have been changing very rapid during the last decades (1, 2). Higher dietary energy, fat and saturated fat intakes, as consequences of changing to a western diet, be-

sides sedentary lifestyle, leads to an alarming increase in the prevalence of overweight and obesity, which are related with cardiovascular disease, type 2 diabetes, hypertension and several types of cancer in the Middle East and North Africa (3-8). Rapid urbanization, economic development, mass media growth, and increased industrialization are factors contributed to the development of changes in diet (1, 9-11). Similarly, the nutrition transition is occurring rapidly in Iran (12). The trend of consumption pattern in Iranians between 1961 and 2005 showed that the availability of energy and all food items had been increased. Moreover, available energy from fruits, meat, and oil had been raised, and energy from dairy and discretionary calorie had been reduced. Discretionary calories are defined as the energy derived from added sugars, solid fats and alcoholic beverages (13).

Socioeconomic factors are significant determinants of health in middle and low-income countries, and diet is one of the main ways that socioeconomic factors can effect on health (14, 15). SES is represented by multiple indicators, including income, education, and occupation, all of which may operate independently or interact in leading to inequalities that influence food choices (16). Since food choice differences between socio-economic groups lead to differences in nutrient intake, better understanding socioeconomic factors that influence the household food basket is essential (17-19).

Iran has experienced significant changes in socioeconomic status (SES) like income level and urbanization rate changes during the recent years (20, 21); however, there are no studies about the association between SES and the trend of changes in different food group consumption.

The aim of the present study was assessing the changes in energy and different food groups consumption related to the socioeconomic status of Iranians household using national Household Budget and Expenditure Survey data from 1991 to 2017.

Methods

This repeated cross-sectional study used secondary data from the Households Income and Expenditure Survey (HIES) conducted yearly by the Statistical Centre of Iran (SCI) since 1991 to 2017 (22). The sample size for the whole study period (1991 to 2017) at the national level was 717432 varied from 15202 to 35254 for each year.

Food cost data of HIES included the amount of all food items in household food basket during last month included purchased foods, foods received as gifts or donations, or food produced by household members. Household food basket data were converted to daily amounts. Since, due to the differences in age, sex, and hence energy requirements, family members do not receive an equal share of the food available for consumption. Therefore, instead of calculating the per capita amount, Adult Male Equivalent units (AMEs) was calculated for each household member (23). AMEs is the ratio of the energy requirement of a household member of a particular age and sex to the energy requirement of an adult male 18 to 30 yr, with moderate physical activity, as recommended by the FAO and WHO (24). In this study, based on the age and sex of household members, the amount of total AME of the household was calculated. Then, the amount of each food item was divided into total AME of household and equivalent to an adult male daily intake of each food item was obtained. Since this amount was purchased foods or foods received as gifts or donations or food produced by household members, we used FAO estimated waste percentages for each food group in the consumption step "In steps from supply to consumption" to estimate the real consumed amount of foods (25). Then, an adapted version of NUTRITIONIST IV software for Iranian foods was used to assess the energy intakes. Food items were categorized into six food groups including “Bread, Cereal, Rice, and Pasta”, “Vegetables”, “Fruits”, “Dairy”, “Meat, Poultry, Fish, Eggs, Legumes, and Nuts” and “Fats, Oils, Sugars, and Sweets”.

In the present study, the food consumption outcome was modeled as a function of household

head age, household head age-squared, socioeconomic variables, household size, place of residence, and household`s head sex. Principle Component Analysis (PCA) was used to extract a socioeconomic status variable. The variables used in the current study for defining SES consisted of educational, occupational, and income status of households. Household head occupational class (included Managers, Professionals, Technicians and Associate Professionals, Clerical Support Workers, Services Workers, Skilled Agricultural, Forestry and Fishery Workers, Craft Workers, Plant and Machine Operators and Assemblers, Elementary Occupations, Armed Forces Occupations), household income, education level, and house area were included in PCA to obtain one variable for socioeconomic status. A factor with the higher eigenvalue was chosen as a socioeconomic variable. All of the imputed items loaded at 0.40 or higher on this factor with. In total, this three factor explained 54.3% of the total variance. The Household was classified based on quartiles of SES.

A cross-classified random effects modeling (CCREM) specifications of Hierarchical Age-Period-Cohort (HAPC) models was used in the present study (26). There were 18 five-year cohorts born from "<1911" to ">1991" based on the household head' ages and 27 periods for each year of study from 1991 to 2017. We formulate a CCREM specification of the HAPC model as follows:

$Y_{ijk} = \gamma_0 + \beta_1$ Household Head $age_{ijk} + \beta_2$ Household Head $age^2_{ijk} + \beta_3$ socioeconomic $class_{ijk} + \beta_4$ Household $Size_{ijk} + \beta_5$ $Place_{ijk} + \beta_6$ Household Head $sex_{ijk} + u_{0j} + v_{0k} + e_{ijk}$ with $u_{0j} \sim N(0, \tau_u)$ $v_{0k} \sim N(0, \tau_v)$ $e_{ijk} \sim N(0, \sigma^2)$

for

$i = 1, 2, ..., n_{jk}$ individuals within cohort j and period k;

$j = 1, ..., 18$ birth cohorts;

$k = 1, ..., 27$ survey years;

The results were obtained using the REML-EB estimation method via the application of the SAS PROC MIXED.

This article resulted from the dissertation of S.R.S. as a Ph.D. candidate in food and nutrition policy.

Ethics of human subject participation: This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Ethical Committees of the NNFTRI and the Faculty of Nutrition Sciences and Food Technology, Shahid Beheshti University of Medical Sciences.

Results

Table 1 represents the socioeconomic characteristics of studied households in each year. During studied years, the age of family head, household education, household income, and percent of the female-headed household had increasing trend, and household size had a decreasing trend.

There was a significantly positive impact on socioeconomic class and a significantly negative effect on household size, male-headed household, and urban residency for calorie consumption (Table 2). As shown in Fig. 1, the households in higher SES quartile consume higher calorie compared to lower SES quartile in all studied years. After 2004, the lines of different SES quartile getting closer to each other that show a decrease in differences in calorie consumption among different SES quartile in recent years.

In Fig. 2, different food groups consumption compared among different SES quartiles from 1991 to 2004. In the case of the "Bread, Cereal, Rice, and Pasta", all SES quartiles had the almost same trend. Higher SES quartiles consume a higher amount of all other food groups compared to lower SES quartiles. Since this higher consumption may be due to the higher calorie intake in more top SES groups, calorie adjusted share of food groups in 2000 Kcal energy intake was calculated, and trends of changes are presented in Fig. 3.

Table 1: The socioeconomic character of households

Year	*N*	*Age of Family Head*		*Household Size*		*House Area*		*Household Education Score*		*Household Income*		*Job of Head Family Rank*		*Sex of head Family*	*Place*
		Mean	Se	Mean	Se	Mean	Se	Mean	Se	Mean	Se	Mean	Se	% of female	% of rural
1991	15202	46.82	0.12	5.52	0.02	89.51	0.48	3.56	0.02	2177822	48317.80	6.13	0.02	0.09	0.44
1992	15246	45.32	0.12	5.38	0.02	88.81	0.48	3.83	0.03	2778638	57188.55	6.09	0.02	0.07	0.44
1993	10807	46.32	0.14	5.24	0.02	89.82	0.57	4.01	0.03	3429260	63517.06	6.10	0.02	0.08	0.41
1994	17608	46.08	0.11	5.28	0.02	93.32	0.45	4.25	0.02	4896315	53292.27	6.03	0.02	0.08	0.35
1995	31799	46.93	0.08	5.35	0.01	95.93	0.33	4.12	0.02	6062084	43176.68	6.11	0.01	0.08	0.40
1996	19176	46.13	0.11	5.22	0.02	91.42	0.40	4.62	0.03	7991071	65063.39	6.25	0.02	0.07	0.46
1997	19267	46.05	0.11	5.13	0.02	91.43	0.41	4.79	0.03	9958109	92654.10	6.27	0.02	0.08	0.47
1998	15342	46.75	0.12	5.13	0.02	91.84	0.44	4.84	0.03	12250166	104149.80	6.30	0.02	0.07	0.49
1999	25769	47.35	0.09	5.16	0.01	91.23	0.35	4.77	0.02	14500433	162065.70	6.27	0.02	0.08	0.53
2000	23726	46.95	0.10	5.00	0.01	90.48	0.34	4.98	0.02	16599525	128480.80	6.33	0.01	0.08	0.52
2001	24165	47.61	0.10	4.92	0.01	91.01	0.34	5.12	0.02	19245184	128296.60	6.32	0.01	0.09	0.52
2002	28500	47.85	0.09	4.82	0.01	92.95	0.31	5.27	0.02	24221762	221226.40	6.32	0.01	0.09	0.50
2003	20684	46.43	0.10	4.71	0.01	93.65	0.35	5.56	0.03	30546117	230044.90	6.30	0.02	0.08	0.50
2004	21606	46.70	0.10	4.68	0.01	94.32	0.34	5.70	0.03	35805680	284557.90	5.18	0.02	0.08	0.50
2005	23878	47.00	0.10	4.56	0.01	93.66	0.33	5.71	0.02	42031891	289410.80	5.17	0.02	0.08	0.49
2006	27649	47.68	0.09	4.44	0.01	92.93	0.30	4.93	0.02	48600638	326677.40	6.33	0.01	0.09	0.53
2007	28005	47.77	0.09	4.34	0.01	93.45	0.30	5.07	0.02	58342611	349792.40	4.99	0.02	0.09	0.50
2008	35032	47.52	0.08	4.17	0.01	93.15	0.26	5.06	0.02	62686496	360643.90	6.39	0.01	0.10	0.49
2009	32790	48.25	0.08	4.14	0.01	92.33	0.26	5.02	0.02	66823575	357263.60	6.39	0.01	0.11	0.48
2010	34239	49.06	0.08	4.05	0.01	92.16	0.25	5.20	0.02	77080796	357050.80	6.35	0.01	0.11	0.50
2011	35118	49.86	0.08	3.99	0.01	93.73	0.24	5.26	0.02	101000000	400144.70	6.37	0.01	0.11	0.51
2012	34658	50.66	0.08	3.90	0.01	94.75	0.24	5.25	0.02	126000000	637835.00	6.39	0.01	0.12	0.51
2013	35326	48.11	0.08	3.72	0.01	92.98	0.22	6.11	0.02	149000000	603501.60	6.53	0.01	0.11	0.50
2014	35419	49.38	0.08	3.69	0.01	94.07	0.22	6.91	0.02	175000000	751542.10	6.51	0.01	0.12	0.50
2015	35591	50.28	0.08	3.64	0.01	94.52	0.21	6.90	0.02	202000000	831262.60	6.50	0.01	0.13	0.50
2016	35576	50.92	0.08	3.59	0.01	94.68	0.21	6.93	0.02	225000000	978253.00	6.48	0.01	0.13	0.50
2017	35254	51.28	0.08	3.59	0.01	95.24	0.21	7.03	0.02	257000000	1045793.00	6.38	0.01	0.13	0.50
Total	717432	48.20	0.02	4.41	0.00	93.08	0.06	5.40	0.00	82485913	142956.30	6.22	0.00	0.10	0.49

Table 2: HAPC-CCREM of the total energy intake: 1991–2017

	Parameter	*Calorie intake (First Model)*		
Fixed Effects		Coefficient	SE	*P* value
INTERCEPT	γ_0	3256.17	65.64	<.0001
Household Head age	β_1	0.25	0.88	0.777
Household Head age^2	β_2	0.39	0.01	<.0001
socioeconomic class	β_3	50.85	1.43	<.0001
Household Size	β_4	-101.40	0.84	<.0001
Place (rural=0)	β_5	-356.23	3.14	<.0001
Household Head sex (female=0)	β_6	-85.41	5.07	<.0001

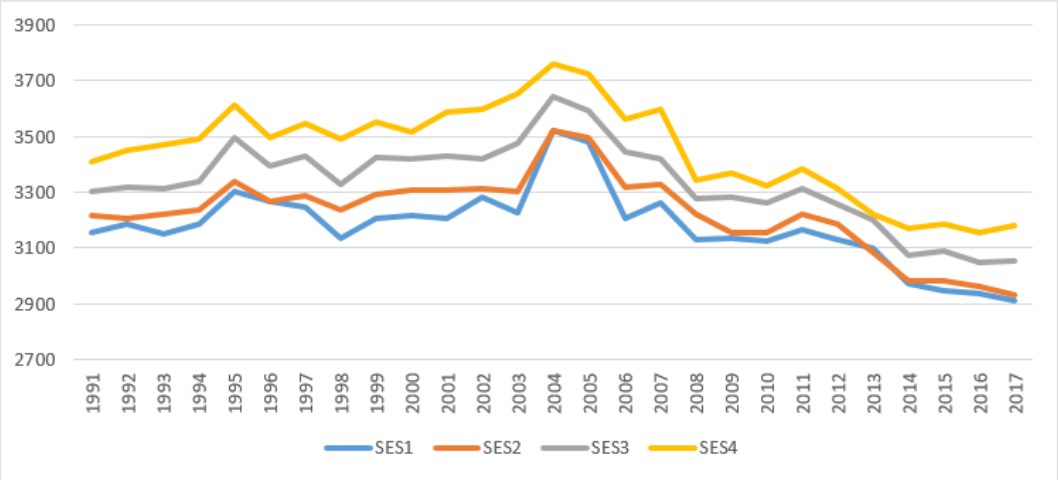

Fig. 1: Calorie Consumption in Different SES

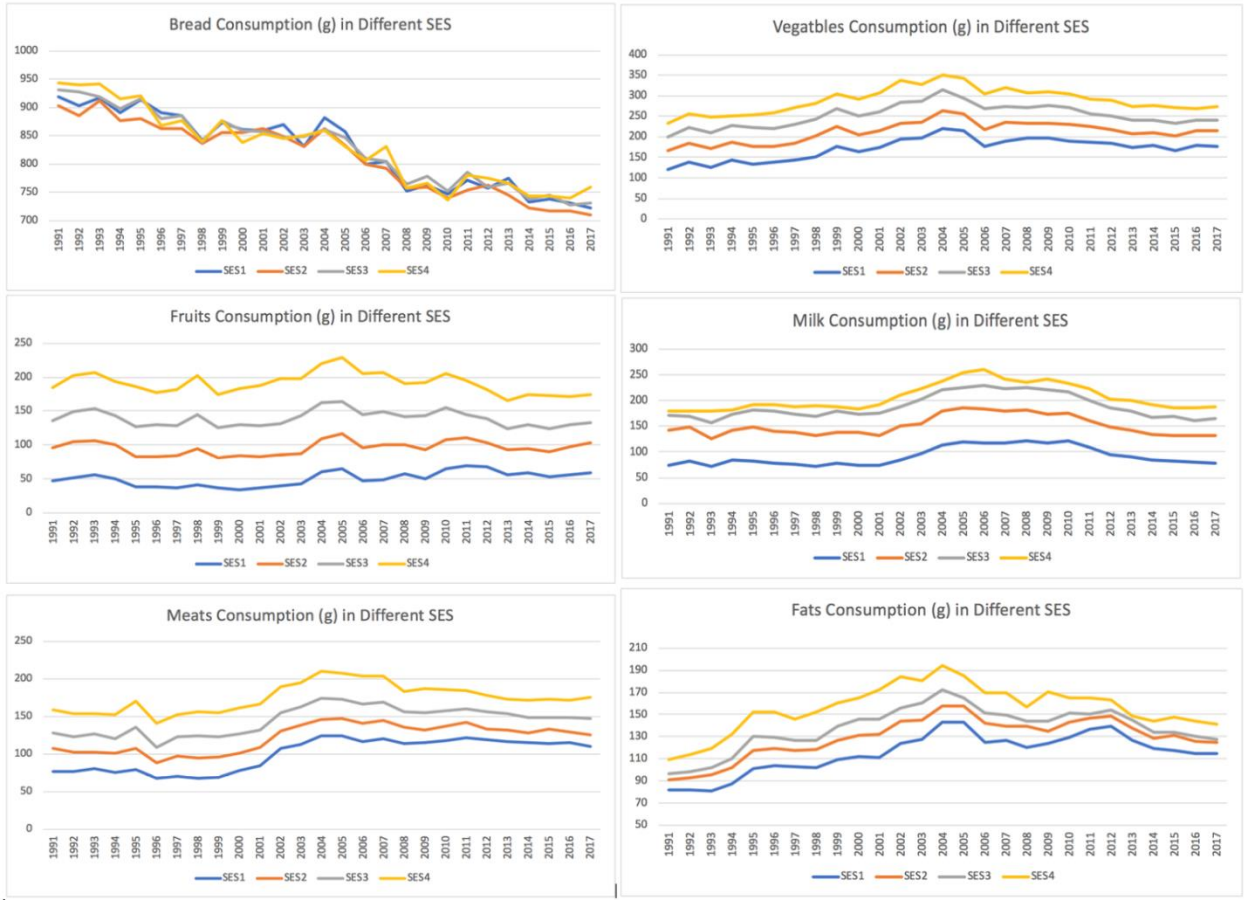

Fig. 2: Food groups consumption in different SES

Lower SES quartiles had a higher consumption of "Bread, Cereal, Rice, and Pasta" compared to more upper SES quartiles. In the case of "Vegetables", "Fruits", "Dairy", "Meat, Poultry, Fish,

Eggs, Legumes, and Nuts" and "Fats, Oils, Sugars, and Sweets", higher SES quartiles consume higher amount rather than lower SES quartiles in all studied years. For "Bread, Cereal, Rice, and Pasta" and "Fats, Oils, Sugars, and Sweets", lines getting closer to each other and consumption in different SES quartiles were getting similar to each other in recent years (Fig.3).

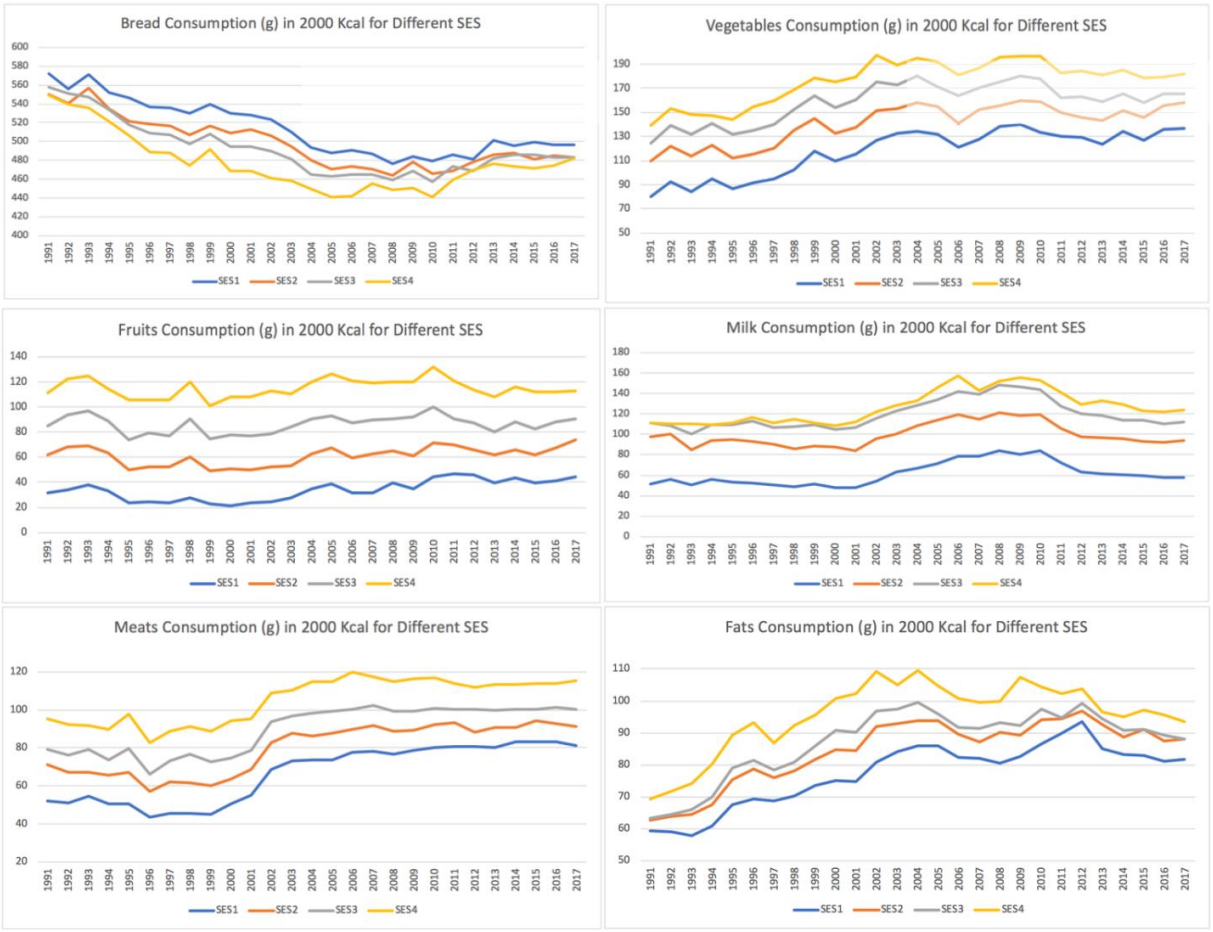

Fig. 3: Food groups consumption in 2000 Kcal for different SES

As shown in Table 3, in the case of the "Bread, Cereal, Rice, and Pasta", socioeconomic class, household size, male-headed household, and urban residency had a significantly negative impact. For the "Vegetables" a significantly negative effect for household size and male-headed household and significantly positive effect for socioeconomic class and urban residency and in the case of the "Fruits" consumption a significantly negative effect for household size and positive significant effect for socioeconomic class, male-headed household, and urban residency were seen. In regards to "Dairy" consumption, there was a significant negative effect on household size and male-headed households and a significant positive effect on socioeconomic class and urban residency. The "Meat, Poultry, Fish, Eggs, Legumes, and Nuts" had a significantly negative effect on household size and significantly positive effect for socioeconomic class, urban residency, and male-headed household. For "Fats, Oils, Sugars, and Sweets" consumption, there was a significant negative effect on household size and urban residency and significantly positive effect for socioeconomic class and male-headed households.

Table 3: HAPC-CCREM of food groups intake: 1991–2017

	Parameter	*Bread, Cereal, Rice, Pasta*			*Vegetables*			*Fruits*			*Dairy*			*Meat, Poultry, Fish, Eggs, Legumes, Nuts*			*Fats, Oils, Sugars, Sweets*		
Fixed Effects		Coefficient	SE	*P* value*	Coefficient	SE	*P* value*	Coefficient	SE	*P* value*	Coefficient	SE	*P* value*	Coefficient	SE	*P* value*	Coefficient	SE	*P* value
INTERCEPT	γ_0	813.37	19.55	<.0001	14.81	0.30	<.0001	10.35	0.21	<.0001	12.38	0.21	<.0001	11.40	0.22	<.0001	11.52	0.18	<.0001
Household Head age	β_1	-0.88	0.31	0.004	0.00	0.000	0.232	-0.01	0.004	0.192	0.02	0.004	<.0001	-0.003	0.003	0.338	-0.02	0.002	<.0001
Household Head age^2	β_2	0.10	0.00	<.0001	0.00	0.000	<.0001	0.001	0.0004	<.0001	0.001	0.0004	<.0001	0.001	0.0003	<.0001	0.0002	0.0003	<.0001
socio-economic class	β_3	-15.70	0.55	<.0001	0.80	0.001	<.0001	1.69	0.01	<.0001	1.30	0.01	<.0001	0.89	0.01	<.0001	0.43	0.005	<.0001
Household Size	β_4	-10.67	0.32	<.0001	-0.61	0.000	<.0001	-0.77	0.00	<.0001	-0.57	0.004	<.0001	-0.48	0.003	<.0001	-0.23	0.003	<.0001
Place (rural=0)	β_5	-73.85	1.21	<.0001	0.65	0.001	<.0001	1.67	0.02	<.0001	0.66	0.02	<.0001	0.42	0.01	<.0001	-0.34	0.001	<.0001
Household Head sex (female=0)	β_6	-8.95	1.96	<.0001	-0.28	0.002	<.0001	0.77	0.03	<.0001	-0.07	0.03	0.007	0.11	0.02	<.0001	0.25	0.002	<.0001

**P*-value is from a cross-classified random effects modeling (CCREM) specifications of Hierarchical Age-Period-Cohort (HAPC)

Discussion

In the present study, by moving to the higher quartiles of SES calorie intake increased. Moreover, there was a positive relationship between "Vegetables", "Fruits", "Dairy", "Meat, Poultry, Fish, Eggs, Legumes, and Nuts" and "Fats, Oils, Sugars, and Sweets" with socioeconomic statues category. In the case of "Bread, Cereal, Rice, and Pasta", there was a reverse relationship, and lower SES quartile consumed a higher amount of this food group.

The effect of socioeconomic class was positive for total calorie intake, "Vegetables", "Fruits", "Dairy", "Meat, Poultry, Fish, Eggs, Legumes, and Nuts" and "Fats, Oils, Sugars, and Sweets", and negative for "Bread, Cereal, Rice, and Pasta". In a study in Australia, low socioeconomic groups were less likely to purchase foods that were consistent with recommendations promulgated in diet-related promotion messages. Disadvantaged groups were more likely to buy fewer types of fruit and vegetables and less regularly than their higher status counterparts (14). In Virginia, lower family socioeconomic status (SES), computed using family income, was associated with higher levels of fat in food purchases and at the highest risk for poor nutrition quality (27). The most deprived Scottish households consume lower fruit and vegetables, brown/wholemeal

bread, breakfast cereals, and oil-rich, and white fish, and higher total bread highest compared with the least deprived households for the period 2007-2009 (28).

In the present study, there was a negative effect on household size for all food groups and total calorie intake. Household size was an essential determinant of expenditures on food, consistent with analyses of household food expenditures in different countries. As Australian household size increased, grocery purchasing behavior was observed to be less compatible with dietary guideline recommendations (29). In Virginia, larger families purchased lower fruit and vegetable purchase and were at the highest risk for poor nutrition quality (27).

The effect of socioeconomic class was positive for total calorie intake, "Vegetables", "Fruits", "Dairy", "Meat, Poultry, Fish, Eggs, Legumes, and Nuts" and "Fats, Oils, Sugars, and Sweets", and negative for "Bread, Cereal, Rice, and Pasta". In Australia, disadvantaged groups were more likely to buy fewer types of fruit and vegetables and less regularly than their higher status counterparts (14). In Virginia, lower family socioeconomic status (SES), computed using family income, was associated with higher levels of fat in food purchases and at the highest risk for poor nutrition quality (27). The most deprived Scottish households consume lower fruit and vegetables, brown/wholemeal bread, breakfast cereals, and oil-rich, and white fish, and higher total bread highest compared with the least deprived households for the period 2007-2009 (28).

The effect of urban residency was positive for "Vegetables", "Fruits", "Dairy", and "Meat, Poultry, Fish, Eggs, Legumes, and Nuts", and negative for "Bread, Cereal, Rice, and Pasta", "Fats, Oils, Sugars, and Sweets" and total calorie intake. Although the 2002-2003 Brazilian Household Budget Survey shows that there was no difference in dietary availability patterns between urban and rural areas (30), Portuguese households located in urban areas had a higher contribution of milk/milk products, fruits, non-alcoholic beverages and fish/seafood (31). Similar to our findings, the consumption of cereals was comparatively higher in the rural sector in all the regions of India compared with the urban area (32). In the USA, city and suburban households allocated less of their food budgets for pork and fats, and more for fruits and juice than rural households (33).

Moreover, male-headed household variable had a positive effect on "Fruits", "Meat, Poultry, Fish, Eggs, Legumes, and Nuts", and "Fats, Oils, Sugars, and Sweets" and a negative effect on "Bread, Cereal, Rice, and Pasta", "Vegetables", "Dairy", and total calorie intake. In Iran, older respondents and females were more careful about their health than young respondents and males (34). The women influenced fruit and vegetable consumption by controlling purchasing and consumption (35). Our finding is consistent with another study in Ghana, where male-headed households consume fewer vegetables and cereals than female-headed households while they rather expend more on fruit consumption (36).

The strength of the current study is using a cross-classified random effects modeling (CCREM) specifications of Hierarchical Age-Period-Cohort (HAPC) models for considering the effect of periods, cohorts, and some socioeconomic factors on dietary intake in Iran. The limitation of the current study is to calculate food consumption based on the Households food Expenditure data. Although Adult Male Equivalent units (AMEs) and FAO estimated waste percentages used to calculate individual consumption, some overestimation is not unexpected.

Conclusion

Households with better SES in Iran had a higher consumption of calorie and all food groups except "Bread, Cereal, Rice, and Pasta" group from 1991 to 2017. Lower income, education, and occupational status in lower SES quartile groups lead to lower calorie consumption and higher consumption of "Bread, Cereal, Rice, and Pasta" food group, which had lower energy cost compared to the other food groups.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Conflict of interest

The authors declare that there is no conflict of interests.

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