

## RESEARCH ARTICLE

# Temporal Variations of Dietary Habits in a High-Risk Area for Upper Gastrointestinal Cancers: a Population-Based Study from Northern Iran

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### Abstract

**Background:** Nutrition transition is a global health problem, especially in developing countries. It is known as an important factor for development of different types of health conditions including cancers. **Objectives:** We aimed to assess the pattern of nutrition transition in a high-risk area for upper gastrointestinal cancers in Northern Iran during the last decade. **Materials and Methods:** This cross-sectional study was conducted on households of Golestan province, Iran. Data on household food consumption between 2001 and 2010 were obtained from the Statistical Center of Iran. The proportions of households with medium/high consumption of main foods were calculated for each year. Joint point software was used for assessing trends. Annual percent changes (APCs) and 95% CIs were calculated. **Results:** In total, 12,060 households were recruited. The APCs (95% CI) of the proportion of households medium/high consumption of cereals, vegetables, legumes, fish, dairy products and meats were -3.1 (-4.1 to -2.2), -2.9 (-3.8 to -2.1), -2.3 (-3.2 to -1.4), -2.8 (-3.3 to -2.4), -1.9 (-3.0 to -0.9) and 2.7 (1.2 to 4.3), respectively. **Conclusions:** We found significant increase in meat consumption among our population between 2001 and 2010. Our results also suggested significant decreasing trend in consumption of so-called healthy foods including, plant foods, fish, and dairy products. Regarding its correlation with health conditions including cancers, nutrition transition should be considered as a priority in health policy making in our region as well as other high-risk populations. It is recommended to conduct community level interventions to increase consumption of plant foods, fish, and dairy products.

**Keywords:** Temporal variation - dietary habits - nutrition transition - cancer - Iran

*Asian Pac J Cancer Prev*, 16 (6), 2537-2542

### Introduction

Over the last decade, the rapid developments in the number of related scientific fields and in particular, extent of population-based epidemiological evidence, has supported to clarify the role of diet in prevention and control of morbidity and immature mortality due to non-communicable diseases (NCDs) (World Health Organization, 2003).

Nutritional transition is a global event that means changes in the quantity and quality of dietary patterns (Drewnowski and Popkin, 1997). Economic factors have important effect on diet, nutrition and health of people in a society. When populations become urban and incomes increase, societies may enter different steps that have been called the nutrition transition (Popkin, 1994).

Several studies have investigated changes in dietary pattern in Western countries including Latin America and Europe. A relatively similar trends in dietary patterns were reported including an increase in consumption of

high-calorie diet, with foods high in saturated fat (mainly from animal sources), added sugars and salt as well as a decrease in using traditional diet, with low intake of complex carbohydrates, dietary fiber, fruits and vegetables (Bermudez and Tucker, 2003; Noah and Truswell, 2003; Mazzocchi et al., 2008).

Similar changes in dietary patterns into Westernized diet have also been reported from developing countries. Rapid industrialization, economic development, and urbanization have resulted in considerable changes in lifestyle and dietary patterns in countries of Asia and Pacific region including Iran (Vorster et al., 1999; Powles, 1992).

Further investigations have also shown a strong correlation between nutrition transition and the prevalence of chronic diseases, especially cancers, suggesting dietary factors as important modifiable determinants for different types of cancers including esophageal cancer (Zhao et al., 2014), breast cancer (Mobarakeh et al., 2014), prostate cancer (Askari et al., 2014) and colorectal cancer (Arafa

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Golestan province located in Northern Iran has been known as high-risk area for upper gastrointestinal cancers since the 1970s (Mahboubi et al., 1973). The results of recent studies from this region showed increasing trends in the incidence of colorectal and breast cancers (Roshandel et al., 2012).

Regarding the importance of nutrition transition on cancers, as well as high incidence of cancers in this region, we conducted this study to assess the trends of dietary changes in Golestan province between 2001 and 2010.

## Materials and Methods

Source of data: Data on household food consumption was obtained from the household income and expenditure survey (HIES) during 2001 and 2010. The HIES was run by the statistical center of Iran (SCI) throughout all provinces of Iran (Population and census office, 2010). Data was collected at household levels. In other words, each household was considered as a study unit. A three-stage sampling was used for selecting eligible samples (households). The first, second and the third stages were areas (cities), clusters and households, respectively. Each cluster included the villages (in rural areas) or blocks (in urban areas). Based on the total number of households in each province, the appropriate sample size was allocated to the areas and clusters. Data was collected by expert and trained interviewers using a structured questionnaire. The questionnaire of HIES was designed considering the recommendations of the United Nations (UN) and according to the national household survey capability programme (NHSCP) (United Nations, 1989) and system of national accounts (SNA) publications (Inter-Secretariat Working Group on National Accounts, 1993). The questionnaire consisted on two major sections including income and expenditure. The section of expenditure was sub-classified into dietary and non-dietary parts.

The dietary part of HIES questionnaire consisted on a list of different food groups including cereals (bread, flour, noodles and its products), meats (red meat, processed meat, poultry meat), fish (fish, shrimp, its products), dairy products (milk, cheese, butter, cream, crud), oils (vegetable oil, animal fat, ghee), fruits (tree

**Table 1. Numbers (N) and Proportions (%) of Households Recruited from Urban and Rural Areas of Golestan Province, Iran**

Year	Urban		Rural		Total
	N	%	N	%	
2001	280	37.10%	475	62.90%	755
2002	730	48.50%	775	51.50%	1505
2003	460	44.20%	580	55.80%	1040
2004	530	49.10%	550	50.90%	1080
2005	530	49.10%	550	50.90%	1080
2006	550	48.70%	580	51.30%	1130
2007	560	44.40%	700	55.60%	1260
2008	690	50.20%	685	49.80%	1375
2009	730	50.90%	705	49.10%	1435
2010	710	50.70%	690	49.30%	1400
Total	5770	47.80%	6290	52.20%	12060

**Table 2. Numbers (N) and Proportions (%) of Households with Medium/High Consumption of Foods in Golestan Province, Iran, 2001-2010**

Year	Cereals		Meats		Fish		Dairy products		Oils		Fruits		Vegetables		Sweets		Spices		Tea		Legumes	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
2001	560	76.9	457	64.1	171	84.2	446	66.2	494	77.1	455	61.1	541	73.3	509	76.5	239	44	636	92.8	417	84.4
2002	1067	73	821	58.4	363	78.4	970	67.2	1018	72.7	898	60.1	1097	73.6	1127	77.9	457	40.8	1245	89.7	990	82.6
2003	744	73.8	602	60.9	258	78.4	716	71.6	649	67.8	607	58.9	723	70.1	738	74.2	322	37.7	834	89.2	648	73.2
2004	760	72	691	67.8	307	74.3	735	70.7	672	67.5	727	68	673	62.9	659	63.7	710	68.7	868	86.8	648	72.4
2005	733	70.3	717	70.8	356	72.8	778	74.2	777	74.5	811	75.8	738	69.2	735	71.2	840	80.5	818	85.2	637	74.5
2006	760	68.7	797	74.8	312	69.5	815	73.4	828	77	773	68.7	665	59.3	751	71.1	859	78.9	914	88	625	71.8
2007	846	68.4	898	76.4	318	69.6	873	71.2	920	76.6	855	68.4	759	60.6	870	72.6	885	72.4	1043	90.3	773	75
2008	786	58.9	806	64.6	296	73.3	868	64.4	838	66.8	906	66	878	64.5	833	64.8	855	67.1	1011	86.8	730	73.8
2009	824	58.8	812	61.6	318	77	863	61.5	864	66.3	939	65.6	1078	75.9	774	60.7	1020	74.9	1096	87.2	661	71.8
2010	772	56.6	879	69.3	280	71.1	804	58.6	874	67.8	1023	73.4	866	62.6	546	43.3	1065	79.9	1046	85.2	599	67.2

fruits, citrus fruits, berries, melons and nuts), vegetables (leafy vegetables, plant vegetables, root vegetables), sweets (sugar and Jams), spices (condiments and other food composition), tea and legumes.

The questionnaire was filled in by interviewers by referring to selected houses. The amounts of foods (in gram) consumed by the household during the last month was asked and recorded. Month of interview (in each year) as well as the structure of the questionnaire did change during 2001 and 2010.

For the present study we obtained data on dietary part of HIES for Golestan province during 2001-2010 from the SCI.

**Statistical analysis:** The amounts of food consumption by households were calculated for each of 11 main food groups (cereals, meats, fish, dairy products, oils, fruits, vegetables, sweet, spices, tea and legumes) in each year. Using the tertile distribution of food consumption, households were divided into three categories of food consumption including the 1st tertile (low consumption), the 2<sup>nd</sup> tertile (medium consumption), and the 3<sup>rd</sup> tertile (high consumption). For each year, the proportions of households in each of the tertiles were calculated. Then, the proportions in 2<sup>nd</sup> or 3<sup>rd</sup> tertiles were merged into a new group called medium/high consumption. The proportions of households with medium/high consumption of foods were used in final analysis. The aim was to assess temporal variations of the proportions of households with medium/high consumption of foods between 2001 and 2010.

We used a Joint point software version 4.0.4 (Statistical Research and Applications Branch, 2013) for trend analysis. Annual percent changes (APCs) in proportions were calculated by generalized linear models assuming a Poisson distribution. Considering the year as independent variable and the neutral logarithm of proportions as

dependent variable, a weighted least-square regression was performed. Heteroscedastic errors were used for calculating 95% confidence intervals (95% CI) of APCs. The trend was considered as significant if the 95% CI of APC did not include zero. We used previously described pairwise comparison models (Kim et al., 2004) to assess the differences in trends of food consumption between rural and urban households. A P-value of less than 0.05 was considered as significant.

## Results

In total, 12060 households were recruited during 2001 and 2010. Tables 1 shows the number and proportion of households recruited from urban and rural areas. The number and proportion of Golestan households with medium/high consumption of main foods are shown in Table 2. We found significant decreasing trends in the proportions of households with medium/high consumption of vegetables, cereals and legumes during 2001-2010 (Table 3, Figure 1).

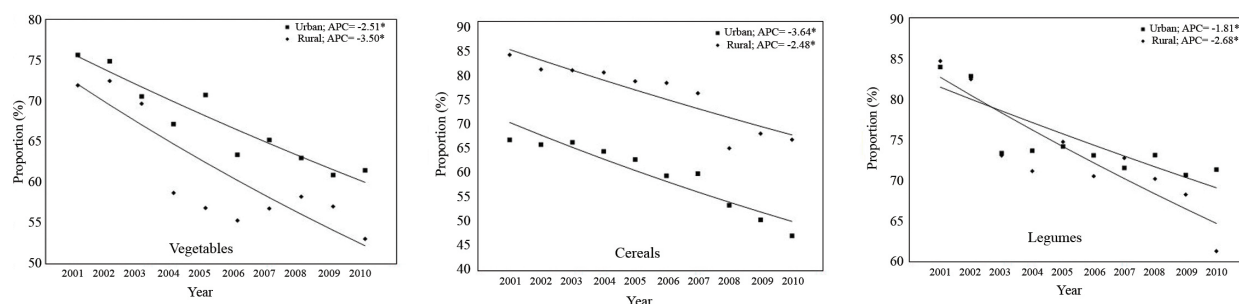
The proportions of households with medium/high consumption of sweets and oils showed significant decreasing trends during the study period (Table 3, Figure 2). Figure 3 and Table 3 show that the proportions of households with medium/high consumption of fish and dairy products significantly decreased and those of meat consumption showed significant increasing trend between 2001 and 2010. We found no significant change in the proportions of households with medium/high consumption of spices and fruits (Table 3). The proportion of households with medium/high consumption of tea showed a significant decreasing trend in rural area, but the trend was not significant in urban households (Table 3).

The results of pairwise comparison analysis showed

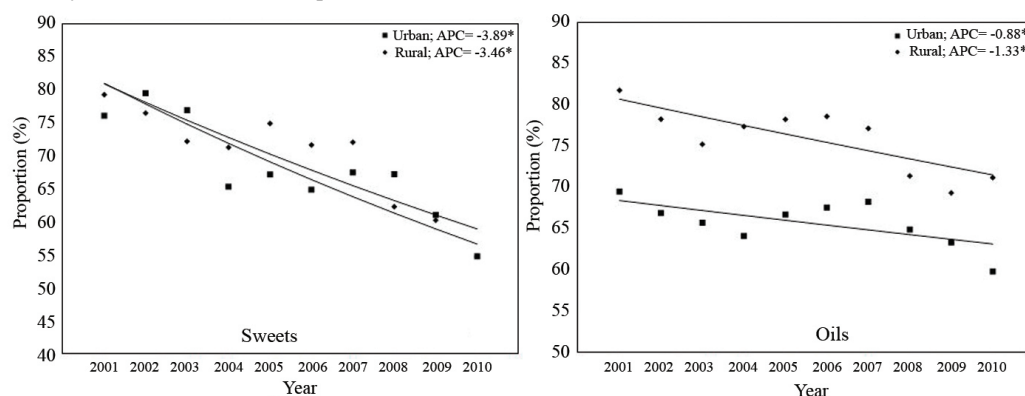
**Table 3. Annual Percent Change (APC) and 95% Confidence Interval (95% CI) of the Proportions of Households with Medium/High Consumption of Foods in Urban and Rural Areas of Golestan Province, Iran, 2001-2010**

Food group	Urban			Rural			Total		
	APC	95%CI		APC	95%CI		APC	95%CI	
Cereals	-3.6*	-4.7	-2.6	-2.5*	-3.4	-1.5	-3.1*	-4.1	-2.2
Meats	1.9*	0.2	3.6	3.4*	1.8	5	2.7*	1.2	4.3
Fish	-2.5*	-3.2	-1.8	-3.1*	-4	-2.3	-2.8*	-3.3	-2.4
Dairy Products	-1.0*	-1.8	-0.2	-3.0*	-4.6	-1.3	-1.9*	-3	-0.9
Oils	-0.9	-1.8	0	-1.3*	-2.2	-0.5	-1.2*	-2.1	-0.4
Fruits	0.5	-0.4	1.5	1.3	-0.1	2.8	1	-0.2	2.3
vegetables	-2.5*	-3.2	-1.8	-3.5*	-4.9	-2.1	-2.9*	-3.8	-2.1
Sweets	-3.9*	-6	-1.7	-3.5*	-5.6	-1.2	-3.7*	-5.6	-1.7
Spices	3.9	-0.5	8.4	3.5	-1.9	9.3	3.8	-1.1	8.9
Tea	-0.1	-0.8	0.5	-1.0*	-1.6	-0.5	-0.6*	-1.1	0
Legumes	-1.8*	-2.7	-0.9	-2.7*	-3.8	-1.6	-2.3*	-3.2	-1.4

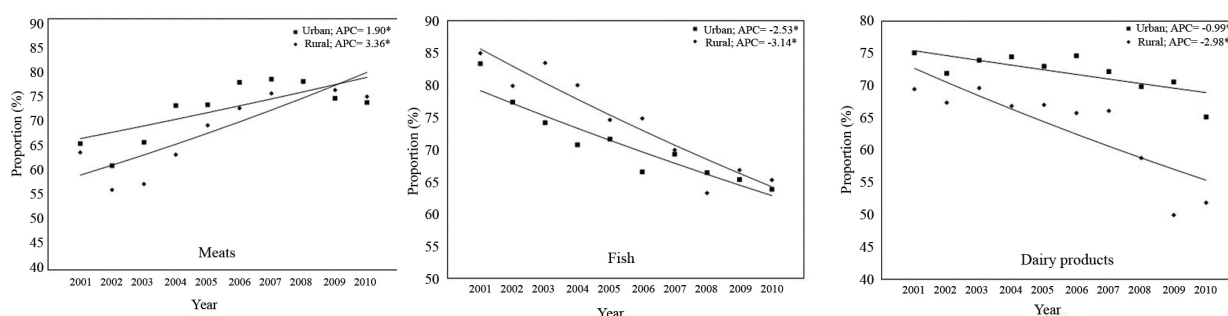
\* APC is significantly different from zero at alpha=0.05



**Figure 1. Proportions (%) of Households with Medium/High Consumption of Vegetables, Cereals and Legumes in Urban and Rural Areas of Golestan Province, Iran, 2001-2010.** (APC indicates annual percent change; \* indicates that APC is significantly different from zero at  $\alpha=0.05$ ; Dots indicate observed values; Solid lines indicate fitted lines)



**Figure 2. Proportions (%) of Households with Medium/High Consumption of Sweets and Oils in Urban and Rural Areas of Golestan Province, Iran, 2001-2010.** (APC indicates annual percent change; \* indicates that APC is significantly different from zero at  $\alpha=0.05$ ; Dots indicate observed values; Solid lines indicate fitted lines)



**Figure 3. Proportions (%) of Households with Medium/High Consumption of Meats, Fish and Dairy Products in Urban and Rural Areas of Golestan Province, Iran, 2001-2010.** (APC indicates annual percent change; \* indicates that APC is significantly different from zero at  $\alpha=0.05$ ; Dots indicate observed values; Solid lines indicate fitted lines)

that proportions of households with medium/high consumption of meats ( $p=0.01$ ), fruits ( $p<0.001$ ), vegetables ( $p=0.001$ ), dairy products ( $p=0.008$ ) and tea ( $p=0.009$ ) were significantly higher in urban than rural areas. Inversely, the proportions of households with medium/high consumption of fish ( $p=0.008$ ), cereals ( $p<0.001$ ) and oils ( $p<0.001$ ) were significantly lower in urban than rural areas.

## Discussion

Dietary habit is a major indicator of human health. Changes in patterns of food consumption may result in developing different kinds of disease including malignancies. Such changes had been occurred in developed countries in previous decades followed by marked increases in prevalence of none communicable diseases. Developing countries are now prone to

experience these changes, called westernization. Therefore, monitoring these trends and, if necessary, implementation of appropriate modifying interventions are important issues in health policy making, especially in cancer control programs, in developing countries. We aimed to assess the variations in patterns of food consumption in Golestan province, a high-risk area for gastrointestinal cancers in Northern Iran.

We found a significant decreasing trend in consumption of plant foods including cereals, vegetables, and legumes as well as fish and dairy products during the last decade.

Lack of adequate knowledge about the benefits of these foods may partly explain such decreasing trends. These foods are usually considered as healthy food, because they meet at least three out of four criteria of healthy food including, 1- to be a good or excellent source of fiber, vitamins, and minerals; 2- to be high in phytonutrients and antioxidant compounds; 3- to be low in calorie



density; and 4- to be readily available (Mayoclinic). These foods have beneficial effects on different organs and may help to reduce the risk of cardiovascular diseases and other health conditions. Low consumption of these foods may cause various conditions including colorectal cancer (Yusof et al., 2012), breast cancer (Mobarakeh et al., 2014), cardiovascular diseases (Kris-Etherton et al., 2003) and osteoporosis (Prentice, 2004). Therefore, educational programs and appropriate interventions should be considered in health policy making to increase consumption of these foods.

Lack of adequate access to these foods may also be considered as another explanation for the observed decreasing trend. Further investigations are warranted to assess different aspects of the decreasing trend in the consumption of these healthy foods in different populations.

According to our results, oils and sweets consumption significantly decreased during the study period. This declining trend may mostly be related to recent policies and interventions (e.g. educational programs) in Iran. Regarding the known effects of these foods on cardiovascular diseases and diabetes (Howard et al., 2006; Weerasingha et al., 2014), a number of programs and interventions were designed and implemented in health system and other related organization of Iran to reduce consumption of these kinds of foods. Our results may indicate that such programs have been effective and their aims have successfully been achieved, suggesting that these programs should be continued and even be reinforced.

We found an increasing trend in the consumption of meats during the last decade. Different studies have shown that high consumption of meats may be related to development of different types of conditions including colorectal cancer (Goldbohm et al., 1994; Arafa et al., 2011; Yusof et al., 2012), cardiovascular diseases (Erlinger and Appel, 2003), metabolic syndrome (Azadbakht and Esmailzadeh, 2009) and type 2 diabetes (Song et al., 2004). Regarding the increasing trends of malignancies in our region, especially colorectal and breast cancers (Roshandel et al., 2012), it is necessary to design and implement appropriate plans for reducing the consumption of these foods. Therefore, it is recommended to consider this point as a priority in health policy making in this region and other similar populations.

According to our results, consumption of the most of foodstuffs including vegetables, legumes, cereals, fish and dairy products showed decreasing trends during the last decades. These decreasing trends may partly be explained by lack of enough knowledge about beneficences of these foods. Changes in the sense of taste in our population as well as changes in the socioeconomic status may also explain the decreasing trend in consumption of foodstuffs.

We found differences in foods consumption between residents of rural and urban areas. This may partly be explained by differences in the lifestyle and the levels of socioeconomic status between the two areas. Such space variations in food consumption should be taken into account for conducting dietary modification programs and interventions. Further studies are warranted to

assess different aspects of these space disparities in our population and other similar areas.

We found a significant decreasing trend in consumption of healthy foods including plant foods, fish, and dairy products during the last decade. Our results also showed that meats consumption significantly increased during the study period. Low consumption of healthy foods and high consumption of meats may result in developing various conditions, especially cancers (Woo et al., 2014). Therefore, modification in dietary patterns towards higher consumption of healthy foods should be considered as a priority in health policy making in our region as well as other similar population, especially in high-risk populations.

## Acknowledgements

This work was supported by Golestan Research Center of Gastroenterology and Hepatology, Golestan University of Medical Sciences. Authors would like to thank the staff of Statistical center of Iran for providing us the data of the household income and expenditure survey (HIES).

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