Correlation Between Risk Factors for Non-Communicable Diseases and Common Cancers in Iran: Ecological Study

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Abstract: Cancer is the second leading cause of death in Iran and the incidence of cancer is expected to double in the next two decades with the increase of life expectancy and the percentage of elderly. Therefore, the present study aims to explore the correlation between the risk factors for non-communicable diseases and common cancers in Iran. the present study is of ecological type in which the information on risk factors of Non-Communicable Diseases (NCDs) were collected from Iran's STEP wise approach to Surveillance of non-communicable diseases (STEPS) and the standardized cancer incidence rate in 2009 was collected from different provinces in Iran. Spearman's or Pearson's correlation coefficients were used for determining the correlation and the relationship between different variables and Poisson regression with the aid of the software STATA version 14 was used for determining the significance of cancer incidence. in Iran 413591 individuals were diagnosed with cancer during 2003-2009 of whom 231572 (56%) were male and the rest were female. The trend of age-standard incidence rate for cancer in males and females has been increasing. There was stronger correlation between the incidence of different types of cancer and risk factors in men, compared with women in a way that there was a positive correlation between daily cigarette smoking and low consumption of vegetables. However, this correlation was statistically significant only for colon, lung bronchus, skin and stomach cancers. Similarly, in women too, there was a positive relationship between daily cigarette smoking and different types of cancer but none of the relationships was statistically significant. However, there was significant relationship between smoking cigarette and the prevalence of colon and lung bronchus cancers in men. considering the increasing trend of cancer incidencea and high level of related deaths on one hand and strong correlation of cancer with risk factors of NCDs on the other hand, control and prevention programs and education on risk factors for NCDs can have a high impact in the reduction of cancer incidence and cancer-related deaths.

Key words: Risk factors for NCDs, cancer, ecological study, spearmans or pearson, consumption

INTRODUCTION

Cancer is one of the main causes of death in Iran and in the world and results in the death of 7.9 million individuals (around 13% of all deaths) each year (Ferlay *et al.*, 2015; Siegel *et al.*, 2015). It is estimated that around 12 million individuals will die due to cancer in 2030 (Ferlay *et al.*, 2013). Around 30% of cancer-related deaths are preventable and many cancers can be prevented by controlling cancer risk factors (Gotay *et al.*, 2015). Cancer, after cardiovascular diseases is the second leading cause of death in developed countries and third leading cause of death in less-developed countries and around 70% of all death due to cancer occurs in countries with average and low income . In Iran cancer is the third leading cause of death with 70000 incidences and 30000 deaths and the aforementioned number is expected to double in the next two decades with the increase of life expectancy and increase of elderly population (Asmarian *et al.*, 2013; Esmaelbeigi *et al.*, 2014).

Cancer is culturally, socially, economically and even politically significant in Iran. Unfortunately, currently cancer is a cultural taboo in Iran and in the public's view

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and even in the views of specialists it is equal to death and this, at least in some cases, results in failure to pursue appropriate therapy. However, cancer is one of the most preventable chronic diseases in a way that 30-40% of cancers can be prevented by correcting lifestyle and this can reach to 80% if appropriate screening are done and the disease is diagnosed early. WHO emphasized the prevention of cancer and the increase of the life quality of patients with cancer in 2014. Therefore, currently creation of national cancer prevention and control programs is one of the medical necessities in any society and the most effective factor in reduction of occurrence of cancer and its burden. In addition, epidemiological studies are the first step in designing of preventive intervention programs. Furthermore, having knowledge or estimation of cancer incidence is necessary for planning and implementation of any cancer prevention and control programs.

Though many studies have been conducted on the risk factors of different cancers in the word, most of these studies are related to developed countries but as mentioned before, the deaths due to cancer are increasing more in third world countries, compared with developed countries. Therefore, this study aims to explore the correlation between risk factors for non-communicable diseases and common cancers in Iran.

MATERIALS AND METHODS

Study design: the present study is of ecological type in which the information on risk factors of Non-Communicable Diseases (NCDs) were collected from Iran's STEPwise approach to Surveillance of non-communicable diseases (STEPS) and the standardized cancer incidence rate in 2003-2009 was collected from 30 provinces in Iran.

Methods for national cancer registration: National Cancer Registry reports which are based on population-based cancer registry reports were used for estimation of cancer incidence rate in 30 provinces. The statistics related to the registration of causes of death are collected, categorized and published by Health Ministry annually. There are 41 universities of medical sciences in Iran and the Health Deputy for each university is responsible public health. In the provinces which have more than one university of medical sciences the central university is responsible for registration and reporting of the information. For data collection, the pathology centers without software collected cancer histories by hand and then the data are electronically collected by Cancer Office of Center for Disease Control and Prevention from provinces once every three months. After data collection,

data quality control is done by Cancer Office of CDC. National ID Code was used for deleting the repeated cases. In this process in order to delete the repeated cases, the deletion was done after editing the data in each province and specifying the same cases with the same morphology, topography, identify and personal information. And finally, it was one once again by specialists for the whole country. The age-standardized incidence rates of the registered cancers were calculated based on ICD-10 for males and females in the country. It should be pointed out that as ARS calculation is done based on specific age groups, the cases in which the age is unknown are excluded from the calculation.

Methods for non-communicable diseases risk factors registration: The care system for risk factors of NCDs in Islamic Republic of Iran is designed with STEPwise approach to Surveillance of non-communicable diseases (STEPS) which is recommended by WHO for obtaining valid data on risk factors of these diseases that are comparable at national and international levels. In this method the data are obtained by cross-sectional survey using questionnaire and physical and laboratory measurements. All universities/faculties of medical sciences under the Ministry of Health and Medical Education in every province were involved in questioning and entering the questionnaire data into computer. In this study the data are collected using personal interview, physical measurements at home and laboratory sampling in valid laboratories.

The samples were selected from all provinces using the information in the Geographical and Encoding Database of Iran Post with a systematic approach and using multistage cluster sampling. The proportionality of dispersion of the selected cluster heads with the dispersion of the number of families in different postal regions of the province and the proportionality of the population of cities and villages are among the characteristics of the employed sampling. The minimum number of sample members in the least-populated province of the country was 2500 individuals which is equivalent to the minimum recommended samples in the WHO recommendation and the highest number of sample members was related to Tehran province and was over 10000 individuals.

Data collection was done in two ways: first, the completion of questionnaire with personal interview and physical measurements with measurement of height, weight, waist circumference and blood pressure and second, laboratory sample collection in verified laboratories.

Data analysis: Spearman's or Pearson's correlation coefficients were used for determining the correlation and the relationship between different variables and Poisson regression with the aid of the software STATA version 14 was used for determining the significance of cancer incidence trend.

RESULTS AND DISCUSSION

In Iran, 413591 individuals were diagnosed with cancer during 2003-2009 of whom 231572 (56%) were male and the rest were female. The raw cancer incidence sex ratio (male to female) was equal to 1.27 and the sex-standard incidence rate was 1.10. The national report of caner registration indicates that the trend of age-standard incidence rates were 132.19 and 123.55 for males and females respectively in 2009 (Fig. 1).

The most common cancers in Iranian men are skin cancer (15.51%), stomach cancer (12.95%) and bladder cancer (10.44%) respectively and three common cancers in Iranian women are breast cancer (25.46%), skin cancer)12.42%) and colon and colorectal cancer (7.76% respectively).

The prevalence of the risk factors for NCDs indicated that 11.1% of mean and 11.9% of women aged over 15 years old have hypertension. Also, the prevalence of obesity (BM=30) was higher in women (14.2%) than in men (6.5%). However, the prevalence of smoking was 9.23% in men and 7.1% in women. The prevalence of lack of fruit and vegetable consumption was (18.65%) in mean and (20.14%) in women and overall, the prevalence of lack of consumption of fruits and vegetables was (19.39).

As shown in Table 1, there was a positive correlation between incidence of different types of cancer and daily cigarette smoking. However, this correlation was statistically significant only for colon, lung bronchus, skin and stomach cancers. Similarly, in women too, there was a positive relationship between daily cigarette smoking and different types of cancer but none of the relationships was statistically significant.

Other findings of this study indicated that there is a positive correlation between the incidence of ten common cancers in Iran and the prevalence of obesity (BMI = 30) and overweight (BMI = 25) in men. This means that the incidence of different types of cancers is increased with the increase of the prevalence of obesity and overweight. When the prevalence of obesity is inserted instead of the prevalence of overweight, the correlation becomes 10% stronger on average for all cancers in men. In women, though there is a positive correlation similar to men, the
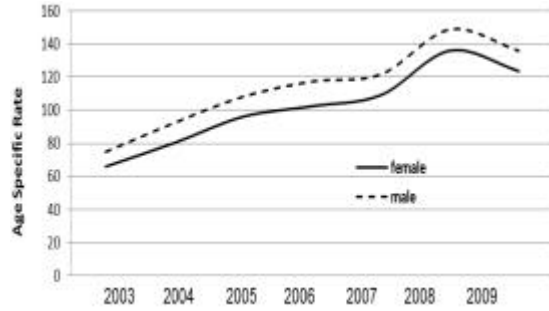

Fig. 1: The trend of age-standard rate (ASR) for incidence of cancer in Iran, based on sex, during 2003-2009

relationship between different types of cancers and overweight is weaker (Tables 1 and 2).

As shown in Tables 1 and 2, three is a positive relationship between low consumption of vegetables and fruits and incidence of different types of cancer and this relationship is significant for colon and anal canal and prostate cancers in men and brain, nervous system, colon and anal canal and esophagus cancers in women.

Other findings of the study indicate that there is an inverse relationship between incidence of different types of cancer and hypertension; the more prevalent is hypertension in a province, the lower is the incidence of cancer and this relationship is significant in bladder and skin cancers in men and ovarian cancer in women.

Cancer registration system in Iran began its activity with the aim of planning for prevention and control of common cancers in 2004. The cancer registration system in the world is the main tool for management and control of cancers. It is an important information source not only for epidemiological studies but also for planning and prediction of events, the correctness of studies and the impact of necessary interventions. The creation, implementation, monitoring and assessment of no interventional and control program on cancer can be one without a cancer registration system with defined standards. Statistics indicate that the relative frequency of cancers is nearly consistent with global reports and by exploring ten common types of cancer in men and women in Iran, this study found that the frequencies of the cancers are similar to the global statistic.

Smoking: Smoking is one of the main preventable causes of death in the world. It is estimated that around 5 million individuals die due to smoking each year in the world and most of these deaths are in average and poor countries.

A positive and significant correlation was found between smoking and colon, lung bronchus, skin and stomach cancers in men in this study and the results are

Table 1: Correlation analysis between Non-communicable diseases risk factors and age specific rate of cancer in male population

Variables	Percentage who currently smoke tobacco daily	Percentage who ate 5 or of fruit more combined servings and vegetables per day	<600 MET -min/week	BMI = 25 kg Mp^{-2}	BMI = 30 kg = Mp^{-2}	SBP = 140 and/or DBP = 90 mmHg
Bladder	0.30	0.30	0.24	0.32	0.35*	-0.43*
Brain, nervous system	0.22	-0.13	0.10	0.06	0.08	0.12
Colon and anal canal	0.51**	0.40*	0.08	0.58**	0.65**	-0.38
Leukemia	0.09	0.14	0.05	0.13	0.16	-0.26
Lung bronchus, trachea	0.60**	0.15	0.04	0.47**	0.42**	-0.36
Non-Hodgkin Lymphoma	0.9	0.05	0.19	0.06	0.10	-0.17
Esophagus	0.26	0.09	0.10	0.14	0.11	0.06
Prostate	0.28	0.50**	0.12	0.41*	0.57*	-0.34
Skin (Non-melanoma)	0.47**	0.20	-0.20	0.43*	0.42*	-0.44*
Stomach	0.63**	0.18	-0.33	0.41*	-0.41*	0.040

Table 2: Correlation analysis between non-communicable diseases risk factors and age specific rate of cancer in female population

Variable	Percentage who currently smoke tobacco daily	Percentage who ate 5 or more combined servings of fruit and vegetables per day	<600 MET-min/week	BMI = 25 kg mP^{-2}	BMI = 30 kg mP^{-2}	SBP = 140 and/or DBP = 90 mmHg
Brain, nervous system	0.24	0.39*	-0.08	-0.10	0.17	0.20
Breast	0.23	0.24	0.20	0.25	0.21	-0.30
Colon and anal canal	0.28	0.57**	0.12	0.47*	0.32	-0.28
Corpus uteri	0.26	0.17	0.18	0.20	0.22	-0.18
Leukemia	0.10	-0.01	0.04	0.15	0.18	-0.18
Esophagus	0.07	0.52**	0.02	0.19	0.24	-0.05
Ovary	0.30	0.01	0.08	0.25	0.16	-0.38*
Skin (Non melanoma)	0.10	0.01	-014	0.27	0.37*	-0.14
Stomach	0.07	0.13	-0.13	0.59*	0.30	-0.30
Thyroid gland	0.04	0.08	-0.09	0.17	0.24	0.26

*,**p<0.05, 0.001

consistent with similar studies (Nascimento *et al.*, 2015). In women, similar to men, a positive correlation was seen between smoking and cancer incidence but the correlation was not significant in the ten common cancers in Iranian women which is probably due to low level of smoking in women. However, as the positive and significant correlation between smoking in men with incidences of colon and lung bronchus was seen in women it can be concluded that smoking in addition to directly increasing cancer incidence possibility directly in the smokers, increases the possibility of smoking in others who are exposed to the smoke through passive smoking. Studies have shown that smoking is the cause of at least 14 different types of cancers in human the most important of which are: lung cancer, skin cancer, pancreatic cancer, bladder cancer, leukemia, breast cancer, laryngeal cancer, liver cancer and colon cancer. Overall, 83% of deaths due to lung cancer and on average, 30% of the deaths due to other types of cancer such as stomach cancer, esophageal cancer, laryngeal cancer and oral cavity cancer are due to smoking (Shin *et al.*, 2014).

Obesity and diet: The prevalence of BMIs of over 30 in men increases the incidence of common cancers for men 10 percent on average, compared with prevalence of BMIs of over 25. Overall, the strongest correlation was found to be between cancer incidence and obesity which is consistent with the findings of similar studies on this subject which introduce obesity as the most effective factor in occurrence of different types of cancer (Eaden

et al., 2001; Simmonds 2000). As over 53 of Iranian adults are overweight, reduction of abdominal fat and maintaining appropriate weight in life is one of the main ways of protection against cancer and other chronic diseases. Though there are multiple biological reasons that justify the role of vegetable and fruit consumption in prevention of cancer, the result of epidemiological studies on this subject are not consistent (Huang *et al.*, 2012; Aune *et al.*, 2011). Healthy diet in addition to reducing cancer incidence, lowers the prevalence of cardiovascular diseases. The findings of this study indicate that there is a direct relationship between the lacks of consumption of 5 times and incidence of ten common cancers in men and women.

Hypertension: The findings of this study indicated that the incidence of cancer is reduced with the increase of the prevalence of hypertension in a province and this reduction was significant in bladder and skin cancers in men and ovarian cancer in women. As age impacts the occurrence of cancer one of the reasons for low cancer incidence rate in societies with hypertension is probably deaths due to other chronic diseases such as cardiovascular and brain diseases. The studies by researchers of cancer center of Texas indicated that beta blockers that are prescribed for reduction of hypertension have anticancer properties through impacting stress hormones. The effect of these drugs on ovarian cancer and the life expectancy of patients has been proven. The study that has conducted on 1425 women with ovarian

cancer that have been treated during 2000-2010 indicates that the use of beta blockers (Propranolol) results in the increase of life expectancy in these patients.

Physical activity: Regular daily physical activity is highly important due to protecting the body against cancers. The findings of this study indicated that the more is the prevalence of physical activity in a province, the less is the possibility of cancer incidence and this is consistent with the findings of similar studies (Monninkhof *et al.*, 2007). Overall any type of physical activit even in a low amount is useful. Physical activity results in reduction of the hormones that contribute to breast and ovarian cancer and it reduces colon cancer by increasing the speed of the passing of food in the digestive system. Appropriate physical activity in addition to reducing cancer risk, highly reduces the incidence of other chronic diseases such as cardiovascular diseases, stroke and type 2 diabetes. Based on the recommendation of WHO at least 30 minutes of physical activity with medium intensity in most days of a week is highly effective in reducing the risk of afore mentioned diseases.

The strengths and weaknesses: Like most ecological studies, this study has some weaknesses. The most important of these weaknesses include ecological fallacy the lack of control of confounding variables and the lack of determining the intensity of the relationship. The strengths of this study include high sample size with considering the ratio of the population of any province to the population of the country, data collection with high quality and accuracy with the help of trained individuals, exploring the common cancers for men and women separately and finally, exploring several non-communicable factors that are highly prevalent in the Iranian society.

CONCLUSION

Considering the increasing trend of cancer incidences and high level of related deaths on one hand and strong correlation of cancer with risk factors of NCDs on the other hand, most cancers can be prevented by changing dietary habits, increasing physical activity and maintaining appropriate weight. In line with this, control and prevention programs and education on risk factors for NCDs can have a high impact in the reduction of cancer incidence and cancer-related deaths.

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