ORIGINAL ARTICLE

Prevalence of lungs cancer risk factors among the Saudi population

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ABSTRACT

Background: Lung cancer is a global burden that represents a leading cancer diagnosis universally. Prevention of lung cancer can be achieved to a great extent through controlling risk factors. However, risk factors of lung cancer are still not well explored in the Saudi community. This survey analysis aimed to evaluate epidemiology and risk factors of lung cancer among general population in different areas in Saudi Arabia.

Methodology: A self-administered structured questionnaire was sent to the public through online "Google forms" including questions on their exposure to different carcinogenic materials, compliance with healthy life measures, and their family history of lung cancer in addition to socio-demographic data. Data were analyzed using SPSS program version 22.

Results: Exposure to smoking is the most prevalent risk factor in Saudi Arabia (28.56%), followed by irritant materials (22.6%). Smoking is significantly higher in age group between 40 to 60 years old (p = 0.012) and those with primary school certification (p = 0.002). Also, subjects in the age group 40 to 60 years old had a significantly higher compliance to healthy diet (p < 0.001) and higher vitamin intake (p = 0.041). The subjects who lived in eastern region had a significantly higher (p < 0.001) incidence of eating healthy food compared to other subjects, while those living in Northern area showed significantly greater weight loss (p = 0.009) compared to other areas.

Conclusion: Awareness programs and smoking cessation campaigns should be held on a national level. Future studies are needed to investigate the level of knowledge and attitude of the general population in Saudi Arabia toward smoking as a major risk factor for lung cancer.

Keywords: Lung cancer; Smoking; Risk; Saudi Arabia.

Introduction

Lung cancer is considered as a major type of cancer death globally [1]. Patients dying from lung cancer annually are higher than those dying from colon, prostate, and breast cancers collectively [2]. In 2010, data reported from the United States showed that total new cancer patients diagnosed by lung cancer were 239,320, while total mortality from lung cancer was estimated as 161,250 cases [3].

These statistics are not different from the global figures. Since 1985 till present, lung cancer showed to be the most common type of cancer globally regarding its occurrence as well as its mortality [4]. During the past few decades, lung carcinoma turned from being an uncommon type of malignancy to the most common type of cancer and cause of death [5].

In the recent years, global statistics in 2012 estimated that there are 1.8 million new patients were diagnosed globally [6], where mortality in the same year was estimated to be 1.6 million deaths. This showed an increase by 200,000 deaths from the year 2008 to the year 2012 [7].

However, it should be realized that the incidence and geographical distribution of the disease can vary among gender, cultural beliefs, profession, and lifestyle of subjects [8]. This can largely influence the exposure to

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different risk factors of lung cancer, including tobacco smoking, as a major carcinogenic material [9]. Other carcinogenic materials can represent occupational risk factors for lung cancer, such as exposure to asbestos, radon, and other chemicals [10].

Other risk factors that were identified as potential precipitators for lung cancer include environmental, behavioral, and cultural risk factors [11]. All these factors can have a major role in the initiation of the carcinogenesis stage and can have a great influence on the response of patients to the exposure to carcinogenic agents [12].

Moreover, risk factors, based on behavioral and cultural beliefs, can vary from one geographical area to another [13]. This can influence exposure to some carcinogenic materials that can differ from one country to another [14].

However, to date, there is a scarcity of data in Saudi Arabia on the risk factors of lung cancer and prevalence of exposure to different carcinogenic materials in Saudi Arabia. Therefore, the aim of this study is to examine risk factors for lung cancer among general population in Saudi Arabia.

Subjects and Methods

This is a cross-sectional, qualitative prospective study that was carried out in Taif University, Saudi Arabia through an online questionnaire in the duration between June and December 2019. Only participants who are Saudi, older than 18-year old and filled the survey were included in the analysis.

An online self-developed questionnaire was distributed, via a link to Google forms, to members of the public; it was also distributed through social media tools like Facebook, Instagram, Twitter, and Telegram. The survey was mainly focusing on collecting demographic data, in addition to the risk factors of lung cancer, including smoking, chronic disease, history of cancer, special food, and family history of cancer, radiological exposure, and complication of cancer, vitamins supplements, and exercise. Sample size was calculated to be 1,500 to 2,000.

Data were represented in terms of frequencies and valid percentages for categorical variables. Chi-square analysis was used to compare categorical variables between the subgroups. All p-values < 0.05 were considered as statistically significant. Analysis of variance analysis was used to compare means among different groups. IBM SPSS (Statistical Package for the Social Science; IBM Corp, Armonk, NY) was used to perform all statistical calculations, version 21 for Microsoft Windows.

Approval by the deanship of male and female affairs was be taken before starting the work. During the research activities, each studied subject was informed about the study objectives stressing on confidentiality of collected data and getting a verbal consent of the subject to share in the study.

Results

Thousand five hundred ninety three participants responded to this online questionnaire in this study. Only participants who completed all the questions in the survey were included. Socio-demographics of participants and analysis of questionnaire is shown below.

Out of 1,593 participants, age was subcategorized into three groups, starting with less than 40-year old and ending with more than 60-year old. Most of the responders (78.9%) belonged to the age group less than 40-year old. On the other hand, the age group who were older than 60-year old had the least number of responses, with only 2.1% of responses.

Turning to place of residence, 51% of the responders were from the western area, while only 2.4% were from the northern region. Monthly income was also examined, 46.2% of participants had a monthly income more than 10,000 SAR. Additionally, 79.1% had a university degree, 62% were single, and 94.4% did not have a family history of lung cancer. All socio-demographic data is shown in details through Table 1.

Participants were asked about their smoking habits, participants who smoked before represented 21.5%, where 8% of them quit smoking less than 5 years ago. Current smoker represented 15.3% of the whole cohort. Only 10.4% smoked more than 5 years ago, and 16.9% started smoking when they were older than 15-year old. Finally, 74.5% of the participants mentioned that they do not stay with smoker when they are smoking. All smoking habits are described in detail as shown in Table 2.

Participants, who smoked, were asked about the type of smoking agent that they smoke and the frequency of smoking. Of the whole cohort, 10.1% smoked cigarettes, while only 0.1% use pipes as shown in Figure 1.

Turning to smoking frequency, 5.7% of the participants smoke less than 10 times per day, 5.5% smoke 10 to 20 times per days, while only 2% smoke more than 20 times per day.

Patients were also asked about the different irritants that they are exposed to at their work. It was shown that 22.6% are exposed to irritant substances at work, and 13% are exposed to these irritants for less than 5 years. Also, participants were asked about their history of cancer and chronic lung diseases. It is revealed that 86.9% did not have a chronic lung disease, while 99.4% did not have cancer previously as shown in Table 3.

Participants who were exposed to occupational risk factors were asked about the type of material they are exposed to. It was shown that 12.9% were exposed to Silica, while only 0.4% were exposed to either soot colly or arsenic as shown in Figure 2.

Turning to chronic lung disease, participants were asked to specify the type of lung disease. It was shown that 8.7% of participants had Asthma, while only 0.1% had emphysema as shown in Figure 3.

Table 1. *Socio-demographic characters of participants.*

	Frequency	Percent
Age group		
Less than 40 years	1,257	78.9
40–60 years	303	19.0
More than 60 years	33	2.1
Nationality		
Non-Saudi	85	5.3
Saudi	1,508	94.7
Place of residence		
Central region	604	37.9
Eastern region	73	4.6
Northern region	38	2.4
Southern region	66	4.1
Western region	812	51.0
Monthly income		
Less than 3,000 SR	422	26.5
3,000–6,000 SR	1	.1
6,000–10,000 SR	434	27.2
More than 10,000 SR	736	46.2
Level of education		
Uneducated	6	.4
Intermediate school	30	1.9
Primary school	15	.9
Secondary school	282	17.7
Academic	1260	79.1
Marital status		
Married	605	38.0
Single	988	62.0
Family history of lung cancer		
No	1504	94.4
Yes	89	5.6

Different risk factors and preventive measures were compared over different socio-demographic variables using Chi-square test at level of significance $p < 0.05$.

The first comparison was done among different age groups. It was shown that participants aged between 40 to 60 years old had a significantly higher incidence of smoking ($p = 0.012$) compared to other age groups, additionally, subjects who aged more than 60-year old, had a significantly higher ($p = 0.038$) incidence of chronic disease compared to other subjects.

Regarding preventive measures, responders aged between 40 to 60 years old showed significantly ($p < 0.001$) higher incidence of eating healthy food and higher incidence of taking vitamins ($p = 0.041$) as shown in Table 4.

The second comparison was done among different educational levels. It was shown that participants with primary school certificate had a significantly higher incidence of smoking ($p = 0.002$) compared to other groups, all other variables did not differ significantly among different educational levels as shown in Table 5.

Since difference in geographical area could precipitate a difference in risk factors for lung disease, different geographical areas in Saudi Arabia were compared together. It was shown that participants living in southern area had a significantly higher incidence of exposure to radiotherapy ($p = 0.033$) and higher incidence of family history of lung cancer ($p < 0.001$) compared to other groups, additionally, subjects who lived in eastern region, had a significantly higher ($p < 0.001$) incidence of eating healthy food compared to other subjects. While those living in Northern area showed significantly greater weight loss ($p = 0.009$) compared to other areas as shown in Table 6.

Discussion

Lung cancer is a global condition that threatens lives of millions of people each year universally [3]. Awareness of

Table 2. *Smoking habits of responders.*

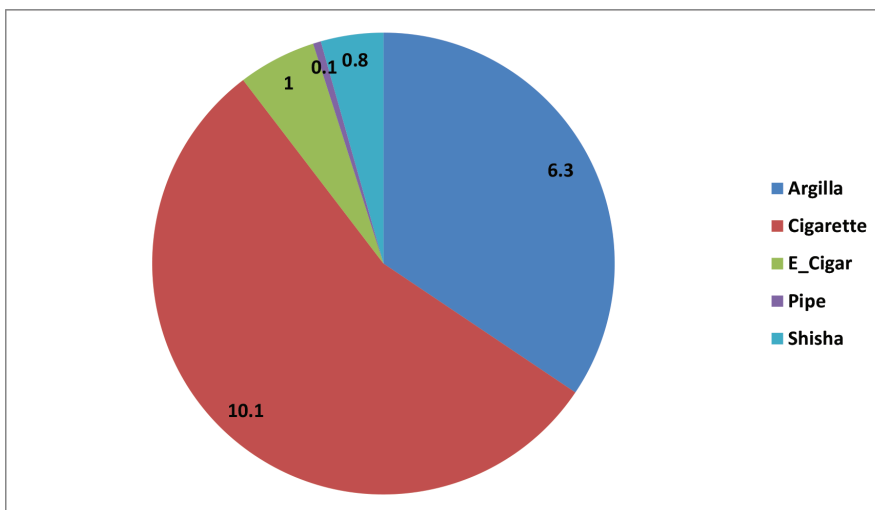|		Frequency	Percent
Have you smoked before?	No	1,251	78.5
	Yes	342	21.5
If yes, when did you stop the smoking?	before less than 5 years	127	8.0
	before more than 5 years	85	5.3
Are you a smoker?	No	1,348	84.6
	Yes	243	15.3
How long have you smoked?	less than 5 years	118	7.4
	more than 5 years	166	10.4
When did you start smoking?	15 years old or less	49	3.1
	more than 15 years old	270	16.9
Do you sit with smokers regularly during their smoking time?	No	1,187	74.5
	Yes	404	25.4

Figure 1. *Types of smoking of responders.*

Table 3. *Exposure to occupational risk factors and medical history of responders.*

		Frequency	Percent
Are you exposed to any irritant material at work?	No	1,302	81.7
	Yes	361	22.66
Duration of exposure	Less than 5 years	207	13.0
	More than 5 years	98	6.2
Do you suffer from chronic lung disease?	No	1,384	86.9
	Yes	209	13.1
Did you have any type of cancer?	Breast cancer	5	.3
	Colon cancer	1	.1
	I did not have cancer	1,583	99.4
	Lung cancer	1	.1
	Prostate cancer	2	.1
	Skin cancer	1	.1
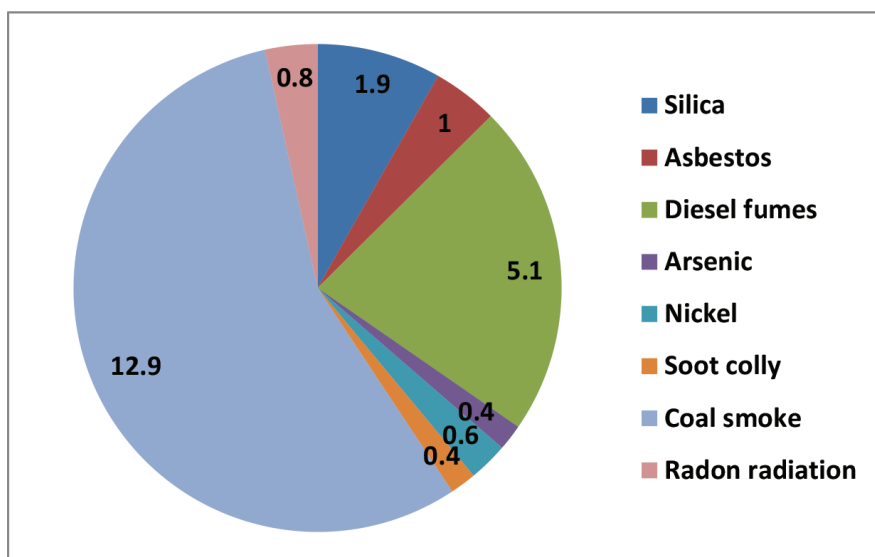
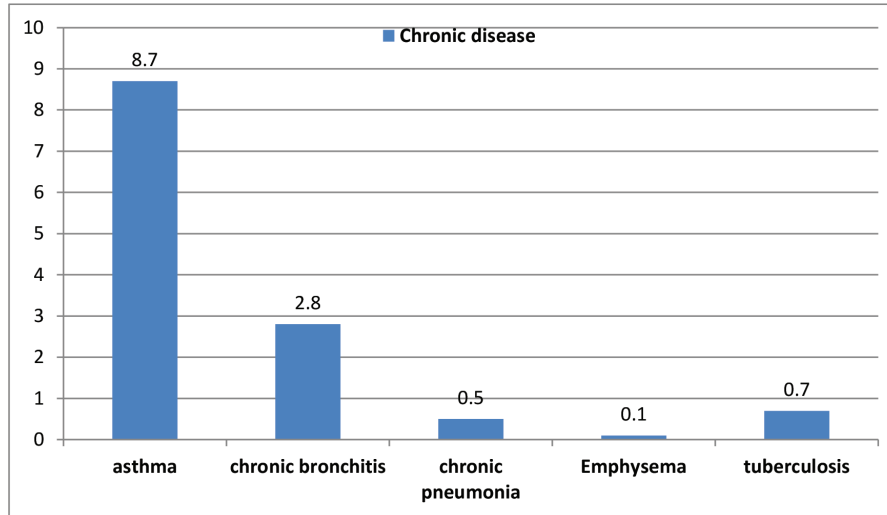**Figure 2.** *Type of irritant material that responders are exposed to.*

Figure 3. *Distribution of chronic lung diseases among the study population in percent.*

Table 4. *Comparison of risk factors and preventive measures over different age groups.*

Age groups		Less than 40 years	40–60 years	More than 60 years	p value
Have you smoked before?	No	80.1%	72.6%	72.7%	0.012*
	Yes	19.9%	27.4%	27.3%	
Do you suffer from a chronic disease?	No	87.8%	84.2%	75.8%	0.038*
	Yes	12.2%	15.8%	24.2%	
Have you previous received radiotherapy?	No	94.7%	95.0%	93.9%	0.945
	Yes	5.3%	5.0%	6.1%	
Family history of lung cancer	No	94.4%	94.4%	97.0%	0.811
	Yes	5.6%	5.6%	3.0%	
Do you eat Healthy food?	No	89.8%	79.5%	84.8%	<0.001*
	Yes	10.2%	20.5%	15.2%	
Loss of weight	No	94.6%	97.7%	97.0%	0.066
	Yes	5.4%	2.3%	3.0%	
Vitamin intake	No	81.1%	74.6%	78.8%	0.041*
	Yes	18.9%	25.4%	21.2%	

*p at level of significance< 0.05.

the risk factors of lung cancer is the first step for effective control of these factors, thus reducing the mortality due to lung cancer [8]. However, risk factors influence can vary from one nation to another [15].

The present investigation aimed to examine the risk factors of lung cancer among general population in Saudi Arabia through a qualitative report. The study revealed that exposure to smoking is the most prevalent risk factor in Saudi Arabia (28.56%), followed by irritant materials (22.6%). Additionally, smoking appeared to be significantly higher in age group between 40 to 60 years old (p = 0.012) and those with primary school certification (p = 0.002).

Turning to preventive measures, subjects in the age group 40 to 60 years old had a significantly higher compliance to healthy diet ($p < 0.001$) and higher vitamin intake ($p = 0.041$). Additionally, subjects who lived in eastern region, had a significantly higher ($p < 0.001$) incidence of eating healthy food compared to other subjects. While those living in Northern area showed significantly greater weight loss ($p = 0.009$) compared to other areas.

Risk factors of lung cancer were also evaluated in different settings. In Iran, Hosseini et al. [15] recruited 242 patients with lung cancer to investigate the environmental risk factors contributing to lung cancer. Hosseini et al. [15] showed that the smoking was the major risk factor for lung cancer in Iran followed by occupational irritants.

Similarly, Hosseini et al. [15] outcomes in Iran came compliant to the findings of the present study, where smoking came in the first rank followed by occupational

Table 5. Comparison of risk factors and preventive measures over different educational levels.

Educational level		Uneducated	Intermediate school	Primary school	Secondary school	Academic	*p* value
Have you smoked before?	No	83.3%	76.7%	60.0%	70.6%	80.6%	0.002*
	Yes	16.7%	23.3%	40.0%	29.4%	19.4%	
Do you suffer from a chronic disease?	No	83.3%	76.7%	73.3%	84.4%	87.9%	0.099
	Yes	16.7%	23.3%	26.7%	15.6%	12.1%	
Have you previous received radiotherapy	No	100.0%	90.0%	93.3%	93.3%	95.2%	0.491
	Yes	0.0%	10.0%	6.7%	6.7%	4.8%	
Family history of lung cancer	No	83.3%	100.0%	86.7%	95.0%	94.3%	0.275
	Yes	16.7%	0.0%	13.3%	5.0%	5.7%	
Do you eat Healthy food	No	100.0%	100.0%	93.3%	90.1%	86.8%	0.096
	Yes	0.0%	0.0%	6.7%	9.9%	13.2%	
Loss of weight	No	100.0%	96.7%	92.3%	93.7%	95.5%	0.682
	Yes	0.0%	3.3%	7.7%	6.3%	4.5%	
Vitamin intake	No	66.7%	83.3%	86.7%	88.3%	77.8%	0.002
	Yes	33.3%	16.7%	13.3%	11.7%	22.2%	

*p at level of significance< 0.05.

Table 6. Comparison of risk factors and preventive measures over different geographical areas.

Geographical areas		Central region	Eastern region	Northern region	Southern region	Western region	*p*
Have you smoked before?	No	80.6%	76.7%	78.9%	81.8%	76.8%	0.476
	Yes	19.4%	23.3%	21.1%	18.2%	23.2%	
Do you suffer from a chronic disease	No	86.4%	86.3%	89.5%	83.3%	87.4%	0.860
	Yes	13.6%	13.7%	10.5%	16.7%	12.6%	
Have you previous received radiotherapy	No	96.5%	98.6%	94.7%	92.4%	93.2%	0.033*
	Yes	3.5%	1.4%	5.3%	7.6%	6.8%	
Family history of lung cancer	No	95.0%	98.6%	100.0%	83.3%	94.2%	<0.001*
	Yes	5.0%	1.4%	0.0%	16.7%	5.8%	
Do you eat Healthy food	No	92.1%	80.8%	92.1%	86.4%	85.1%	<0.001*
	Yes	7.9%	19.2%	7.9%	13.6%	14.9%	
Loss of weight	No	97.2%	95.7%	86.5%	95.1%	94.1%	0.009*
	Yes	2.8%	4.3%	13.5%	4.9%	5.9%	
Vitamin intake	No	82.5%	82.2%	68.4%	78.8%	78.2%	0.122
	Yes	17.5%	17.8%	31.6%	21.2%	21.8%	

*p at level of significance< 0.05.

irritant materials. Additionally, the present study included subjects from the general population with a larger sample size, which increases the reliability of the present investigation.

Moreover, the present study examined the preventive measures and lifestyle modifications that could decrease the incidence of lung cancer. These factors were not studied by Hosseini et al. [15]. It was shown that eating healthy diet, losing weight, and taking vitamins were the most prevalent preventive measures adopted by the Saudi population.

From Iran to the UK, Simon et al. [16] investigated the risk factors and predictors of lung cancer in the English general population. Simon et al. [16] recruited 191 subjects to achieve the study objective. Simon et al. [16] showed that the level of awareness of the general population toward risk factors of lung cancer is considered as poor, and that further attention is required to smoking as a risk factor for lung cancer in the UK.

Although the present study did not examine the level of the public toward risk factors of lung cancer, the current investigation agreed with Simon et al. [16] findings in

that smoking is a global and major risk factor for lung cancer that requires an urgent action to minimize the risk of lung cancer.

Returning back to the Asian continent, Ganesh et al. [17] in India examined the risk factors of lung among Indian population through a case control investigation. Ganesh et al. [17] recruited 408 subjects with lung cancer and 1,383 normal subjects. Ganesh et al. [17] evaluated smoking, occupational hazard and dietary factors as potential contributors to lung cancer.

Ganesh et al. [17] showed that exposure to red meat, coffee, smoking, and pesticides were the major risk factors for lung cancer in the Indian community. On the contrary, the present study did not find any significant correlation between dietary factors and occurrence of lung cancer, however, healthy diet, and vitamins intake proved to be significantly effective measures to reduce the incidence of lung cancer in Saudi Arabia.

Additionally, the present study had some limitations; it did not correlate the level of knowledge towards risk factors of lung cancer to incidence of lung cancer. This limitation should be considered in future studies. To our knowledge, this is the first study to evaluate the risk factors of lung cancer among the Saudi population.

Conclusion

Smoking is a major burden on the Saudi economy as well as health of adults in the kingdom. Awareness programs and smoking cessation campaigns should be held on a national level especially among university students and adults to aware them of the hazards of smoking in terms of lung cancer. Future studies should focus on evaluating the level of knowledge and attitude of the general population in Saudi Arabia towards the hazards of smoking as a major contributing factor to lung cancer.

List of Abbreviations
SAR   Saudi Riyal
SPSS   Statistical Package for the Social Science

Conflict of interest
The authors declare that there is no conflict of interest regarding the publication of this article.

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Consent for publication
Written consent was obtained from all the participants.

Ethical approval
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