

Identification of thyroid cancer risk factors incidence in urban and rural areas, Pakistan

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Abstract: As like the other countries, the risk of thyroid carcinoma is significantly increasing over the last few decades in Pakistan. This study aspires to know the cause and effect of this disease in urban and rural areas by investigation of different risk factors. For this purpose, incidence data was collected from Institute of Nuclear Medicine & Oncology Lahore and Sheikh Zayed Hospital, Lahore. This study consists of 88 rural and 232 urban patients and the possible risk factors of thyroid cancer investigated via questionnaire. The logistic regression is used as a statistical tool and the results are computed on the behalf of odd ratios. The result shows that 48 rural and 112 urban cases are suffered from thyroid cancer. In rural areas two factors use of iodine diet and oxidative stress are seen to be significant with odd ratios 1.642 and 1.796 while in the urban areas seven factors residential Area, oxidative Stress, too much consumption of meat & fast food, too much use of crucifer vegetables, excess use of fats and sea food are seen to be significant with odd ratios 0.760, 2.121, 1.294, 1.187, 1.618, 1.632 and 0.892, respectively. It is observed that the oxidative stress is the common factor in urban and rural areas.

Keywords: Thyroid carcinoma, oxidative stress, iodine diet, crucifer vegetables, odds ratio.

INTRODUCTION

An increasing trend of different types of cancer incidences in males and females are observed in Pakistan. This trend may be increased by various factors such as unhealthy diet and life style, exposed of radiations, lack of knowledge about disease and treatment etc. Thyroid cancer is noted as 6th most common carcinoma in females in Lahore, Pakistan (Masood *et al*, 2018).

Thyroid cancer increased rapidly day by day. a frequently increased in rate is seen in United State rather than the others (Jung, *et al*, 2013). According to the survey of 2017, 56870 new cases were appeared and among of this 2,010 persons died due to thyroid cancer (Wirth and Shah, 2017). According to American cancer society most of deaths are caused of cancer. The estimated new cases of thyroid cancer in both sexes were 56,870 and estimated deaths were 2,010 in US, 2017 (Siegel, *et al*, 2017). In 2017, Lei *et al* explore that the nationwide incidence of thyroid tumour in urban and rural areas was 15.03 and 5.41 out of 100,000.

The number of deaths in urban areas was 1.41 times higher than in rural areas. In the time period of 1991-2006, thyroid cancer incidence rate was increased 156% in Canada. After the controlling of socioeconomic factors, a comparison made among the towns or rural and urban areas and it was seen that the prevalence of thyroid malignant cells is highly associated with income quintile in urban areas as compared with rural areas (Guay, 2014). A trend was observed in US during 1995 – 2013 that the

possibility of breast, thyroid and prostate tumour was higher in urban areas while the rural areas had high rates of tobacco and HPV associated cancer (Zahnd, 2018).

It was observed that education level and socioeconomic status also impact of thyroid cancer. 69.8% of the cases are observed in urban areas (Zivaljevic, *et al*, 2014). The clear picture of thyroid cancer incidence is seen in urban/rural areas in New York State during 2008-2012. This study express that urban areas have 50% high chances of thyroid cancer than rural areas (Conwell & Boscoe, 2015).

Oxidative stress is found to be most significant risk factor in thyroid cancer that generated due to unbalancing of oxidative and ant oxidative molecule. Similarly excess or shortage of iodine, radiation exposure and use of unhealthy diet are also found significant risk factors (Asif, *et al*, 2018).

The aims of the study are to identify the various risk factors of thyroid cancer by using analytical approach and developing the appropriate statistical models to explain the strength of the significant risk factors of Thyroid Cancer in urban and rural areas.

This research was done to recognize the risk factor of thyroid cancer in urban and rural areas. For this purpose, the data was collected by a self-designed performa from the Sheikh Zayed and Institute of Nuclear Medicine & Oncology Lahore, Pakistan.

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MATERIALS AND METHODS

For the data collection a self-designed Performa was used and the reliability of Performa was computed by Cronbach's Alpha test and found to be 0.742. The data based on information from the individual about the characteristics like residential area, oxidative stress, use of iodine diet, acromegaly disease, etc, 88 rural and 232 urbans were collected in 2013. The binary variable was taken as regress and variable and all the other regressors variables were categorized as different scale.

Ethical approval

Permission of Ethical Committee Permission was obtained from ethical committee of the hospitals before the observational study and intervention. The committee was comprised of Consultant Medical Specialist, Consultant Oncologist, Consultant Nephrologist and Director of the Hospitals. (Ethical approval reference number: 1244-GCU-MPHIL-STAT-11, ST-71/13, Date: 11-04-2013).

STATISTICAL ANALYSIS

For analytical work SPSS (Statistical Package for Social Sciences) version 16.0 was used. Analytical outcome were obtained separately for rural and urban by using the different statistical tools including chi-square test of independence and logistic regression models. The Odds ratios (OR) with 95% level of confidence were estimated by using the binary logistic regression model.

RESULTS

Binary logistic regression model technique was applying for data analysis and the regression slop, OR, *p*-value and confidence interval at 95% for OR were computed for rural and urban data. For the consequence of the variables with their *p*-value is compared with the predefined value. For the adequacy of the model, two tests introduced by Hosmer and Lemeshow in 2000, are used. The significance value of Omnibus test at 0.000 *p*- value for rural data is 23.954 and for urban data are 91.770. It shows that the significant effect of information of at least one of the factor, elucidate by the model. The Hosmer and Lemeshow test (goodness of fit) is much better than other traditional chi-square tests (Hosmer and Lemeshow, 2000). In this study, it was observed that the for rural and urban data HL test is insignificant with $\chi^2= 0.105$ at $p=0.949$ and $\chi^2= 10.403$ at $p=0.238$ showing that the model is adequately fitted. The Cox and Snell's R_{cs}^2 statistics and Nagelkerke's R-square are used to observe the goodness of fit, the values of Cox and Snell's R_{cs}^2 statistics and Nagelkerke's R-square for both rural and urban are 0.238 & 0.319 and 0.327 & 0.436, respectively.

From table 1, it is observed that among 88 rural patients, 44 (91.7%) cases suffered with thyroid cancer and 19 (47.5%) without thyroid cancer are correctly predicted. The correctly classification of the data with their percentages is 63 (71.6%) respectively and it is observed that correctly classification is much higher than misclassified which adequately fitted the model.

Similarly, from table 2, it is observed that 82 (73.2%) patients diagnosed with thyroid carcinoma are correctly predicted. The percentage of correctly & incorrectly classified cases are 175 (75.4%) and 57 (24.6%), respectively. The correctly classification value is higher than incorrectly, so the builded model is satisfactory.

For the interpretation of two model coefficients, their odds ratios and confidence interval of these odd ratios are discussed in table 3 and table 4. If the odd ratios of these factors are found to be positively significant then it's mean they are directly related to thyroid cancer.

In the model for rural, two risk factors are investigated which is directly related to thyroid cancer in rural areas in table 3. The generated logistic model of these two factors is:

$$Z=1.970 + 1.642 * (\text{Iodine}) + 1.796 * (\text{Stress})$$

The odd ratio of subject suffered from oxidative stress is 1.796 which indicates that a person has 1.796 times higher chances of thyroid tumor as compared to healthy persons. Similarly, the odds ratio of iodinated patients has 1.642 times more risk of thyroid cancer as contrast to those who has not consumed much iodine.

Similarly, for urban areas, the seven risk factors are also found to be major factors towards thyroid carcinoma in Table 4. The generated logistic model is following that:

$$Z= 2.624 + 0.760 * (\text{Area}) + 2.121 * (\text{Stress}) + * 1.294 (\text{Meat}) + 1.187 * (\text{Fast Food}) + 1.618 * (\text{veg use}) - 1.632 * (\text{Fats_use}) + 0.892 * (\text{Sea Food})$$

The logit model for urban areas describes that the subject having oxidative stress problems has 2.121 times more chances of suffered from thyroid cancer as compared to those whose have not any stress issues. Similarly, the odds ratio for residential area is 0.760, for meat user is 1.294, for use of fast food is 1.187 and for use of vegetables is 1.618 and for sea food user the odd ratio is 0.892. The oxidative stress is seeming to be as a highly significant risk factor of thyroid carcinoma in urban areas with the odd ratio 2.121.

DISCUSSION

Thyroid carcinoma is seen to be a most highlighted issue in developed countries. It's clearly effects also observe on

Table 1: Classification table for rural areas

		Predicted		
		Thyroid Cancer		Percentage Correct
		Yes	No	
Thyroid Cancer	Yes	44	4	91.7
	No	21	19	47.5
Overall percentage				71.6

Table 2: Classification table for urban areas

		Predicted		
		Thyroid Cancer		Percentage Correct
		Yes	No	
Thyroid Cancer	Yes	82	30	73.2
	No	27	93	77.5
Overall percentage				75.4

Table 3: Variables in the equation in rural areas

Factors	β	S.E	Wald	df	Sig	Exp(β)	95% CI for Exp(β)	
							Lower	Upper
Iodine	1.642	.527	9.700	1	.002	5.164	1.838	14.512
Stress	1.796	.515	12.144	1	.000	6.025	2.194	16.542
Constant	-1.970	.512	14.794	1	.000	.140		

Table 4: Variables in the equation in urban areas

Factors	β	S.E	Wald	df	Sig	Exp(β)	95% CI for Exp(β)	
							Lower	Upper
Area	.760	.331	5.282	1	.022	2.138	1.118	4.087
Stress	2.121	.373	32.410	1	.000	8.343	4.019	17.318
Use of meat	1.294	.385	11.301	1	.001	3.646	1.715	7.752
Use of fast food	1.187	.358	10.988	1	.001	3.276	1.624	6.608
Use of veg	1.618	.649	6.216	1	.013	5.041	1.413	17.978
Use of fats	-1.632	.444	13.510	1	.000	.196	.082	.467
Use of sea food	.892	.411	4.704	1	.030	2.440	1.090	5.462
Constant	-2.624	.450	33.950	1	.000	.073	-2.624	

rural and urban areas. According the study of Yang *et al* (2017) in China, it was observed that the rate of thyroid malignancy in urban areas was 1.41 times higher than that of rural areas.

This research is conduct to find the reasons or factors of thyroid malignancy and it is observed that oxidative stress is highly significant risk factors in both urban and rural areas. The OR at 95% confidence interval signified that the oxidative stress in urban area has 2.121 times more higher risk of thyroid carcinoma as compared to the oxidative stress in rural area with OR 1.796. Oxidative stress may be become the cause of the cardiovascular diseases, degenerative neurological disorders, and other carcinoma in thyroid cancer patients. The disorder in oxidative or anti-oxidative molecules is associated with thyroid cancer (Xing, 2012). The imbalanced and rapid growth of oxidative molecules became the big cause of thyroid cancer (Asif, *et al*, 2015).

The use of iodine diet is found to positively significant with thyroid cancer at the odd ratio 1.642. The mostly deaths of thyroid patients in past decades due to deficiency or excess of iodine are to be seen and it is familiar as major risk factor of thyroid carcinoma (Vecchia *et al*, 2015)

Intake of fast food and Sea food items are found to be positively associated with thyroid cancer with odds ratio 1.187 & 0.892 and the persons who are using these diets more than 2 days per week having high chances of thyroid cancer. Too much consumption of rich iodine food increased the risk of thyroid malignancy. Use of cruciferous or green vegetables is also directly associated with thyroid cancer with the odd ratio 1.618. A rich nutrients diet including cruciferous vegetables has a positive result on thyroid cancer (Vecchia *et al*, 2015)

Consumption of meat is also positively associated with thyroid cancer. Too much use of red meat, as well as chicken demonstrates a positive involvement with thyroid cancer (Memon *et al.*, 2002). The use of fats in the form of butter and cheese is also associated with thyroid malignancy. The intake of fats from butter having OR=1.6 with confidence interval 1.1-2.5 and from cheese having OR=1.5 and confidence interval 1.0-2.4 (Galanti *et al.*, 1997).

Limitation

In order to conduct the further research on thyroid cancer one can conduct the similar study in various regions of Pakistan. Further a comparative study can be conducted between the private and public cancer hospitals of Pakistan. A new research is required to examine the effect of iodine and radiation exposure of blasts on thyroid cancer. One can extend this study to observe the effect of laser and radiation treatment on thyroid.

There are limitations in our ability to afterward evaluation the characteristics developing from experimental studies in this disease.

CONCLUSION

Thyroid cancer is one of the most common and hurriedly increased carcinoma in the world. This study is informative and full of awareness about the effect regarding the different risk factors of thyroid cancer in rural and urban areas of Lahore. It is clearly observed from the results in tables 3-4 that oxidative stress is common and highly significant factor in both areas.

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