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ESTIMATION OF INFLUENCE OF SOME MODIFIABLE RISK FACTORS ON CHRONIC DISEASES BASED ON IHDS DATA

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ABSTRACT

Study has been made to identify and quantify the risk factors for leading chronic disease viz heart disease, diabetes and cancer in India based on a relatively recent large scale nationally representative survey. An additional aim is to assess and compare the influence of modifiable risk factors among different age groups and different areas of residence. The diseases analysed are diabetes, cancer and heart diseases. The choice of these three diseases has been dictated by their importance.

Key words: Cancer, Chronic disease, Diabetes, Heart Disease, Logistic regression, Modifiable risk factors, Risk factors.

INTRODUCTION

"A silent pandemic of chronic diseases is gradually enveloping the world population, spreading to all corners of the globe. This distinct spectrum of human afflictions is systematically replacing infectious and parasitic diseases as the leading cause of morbidity and mortality worldwide, thereby producing one of the greatest health challenges of all time" (Harris, 2011).Two clear trends have been visible in this domain in the course of the last few decades. First the scourge of infectious diseases has steadily declined. Second and as a consequence of the first, longevity has seen a steady increase. However increasing longevity has meant that chronic diseases are increasing at an alarming pace. Chronic diseases such as cardiovascular diseases, diabetes and cancer are responsible for a high proportion of deaths and disabilities and are emerging as major public health problem in India.

Chronic diseases are more common among elderly people (Kirch, 2008), but are increasingly being apparent in middle age. However the exposures and risk factors that precede disease onset can occur at any stage of life. Chronic diseases are mostly not curable, that is, the individual can almost never return to a pre-diseased state and therefore chronic diseases require continuous management (Leventhal et al., 2005). "Certainly everyone has to die of something, but death does not need to be slow, painful, or premature ...Chronic disease prevention and control helps people to live longer and healthier lives" (WHO, 2005). Therefore it is important to identify the risk factors and give people the opportunity to change them where possible before onset of disease or once disease has developed to modify behaviour and prevent or delay the progression. The goals of chronic disease prevention and management are to prevent disease occurrence, delay the onset of disease and disability, lessen the severity of disease, and improve the health-related quality and duration of the individual's life (Doll, 1985). Risk factors of chronic diseases can be categorized into two major groups- modifiable and non modifiable risk factors. An example of a modifiable risk factor is BMI (Body Mass Index) while age is an example of non modifiable risk factor. While the risk factors are well known, pretty little can be done to reduce the influence of non modifiable risk factors. Much of the burden of disease caused by chronic diseases can potentially be prevented by focusing on the modifiable risk factors. This paper therefore focuses on modifiable risk factors and examines their influence on leading chronic diseases of India. The analysis is based on a country wide large scale survey.

As far as is known, not much work has been done on identification and quantification of risk factors of chronic diseases based on any large scale pan India based survey. Most studies have been hospital based or conducted over limited geographies.

MATERIALS AND METHODS

In this paper, data from the Indian Human Development Survey (IHDS), 2005 has been used. IHDS was jointly carried out by University of Maryland and the National Council of Applied Economic Research (NCAER) India. It is a nationally representative multi topic survey of 41,554 households in 1503 villages and 276 towns and cities across all states and union territories of India except Andaman Nicobar and Lakshadweep islands. It includes both individual and household level responses on various topics such as education, employment, health, fertility, and gender relations. Stratified sampling design was used for selecting the sample from all over the country.

In 2009, IHDS was the top most download survey for surveys outside of United States in respect of downloads from ICPSR (Interuniversity Consortium for Political and Social Research located at University of Michigen) archive of over 7000 studies.

IHDS (2005) has two major datasets- Individual dataset and Household dataset. The analysis was carried out on the individual dataset which consists of 2,15,754 cases, each with 211 variables. The household dataset has 41,554 cases each with 937 variables. Two one-hour interviews in each household covered health, education, employment, economic status, marriage, fertility, gender relations, and social capital.

In this paper, the aim is to examine and quantify the association between modifiable risk factors and diseases such as heart disease, diabetes and cancer. The modifiable risk factors chosen are tobacco smoking, BMI, high BP, per capita edible oil consumption, per capita milk product consumption and per capita non veg consumption.

"To look at the association between a risk factor and disease, there are many available methods. In the field of public health and medicine, arguably the most popular method is logistic regression" (Hosmer and Lemeshow, 2000).

Logistic regression analyses were carried out separately for heart disease, diabetes and cancer with respect to different modifiable risk factors.

For the logistic analysis, the dependent variable was disease, operationalized as a binary response variable – yes (having disease) and no (do not have disease). Independent variables in the logistic regression equation were modifiable risk factors. Estimate of the parameter (B), corresponding standard error, p values, odds ratio and 95% confidence interval of Odds ratios (OR) were calculated. p values of 0.05 or less (2-tailed) is considered statistically significant. Data were analyzed using SPSS. For a primer on Logistic Regression, one is referred to Borooah (2004, page 129).

To compare two logistic regression models, Wald statistic (Allison, 1999) has been used which is given by

$$\text{Wald Statistic} = \frac{(\beta_1 - \beta_2)^2}{[SE(\beta_1)]^2 + [SE(\beta_2)]^2} \sim \chi_1^2$$

where β_1 and β_2 are the coefficients of logistic regression model for the 1st and 2nd logistic regressions respectively and χ_1^2 is the chi square statistic with 1

degrees of freedom. Moreover SE (β_1) and SE (β_2) are the standard errors of estimates of parameters for the 1st and 2nd regression model respectively.

Exclusion criterion :

Checks have been carried out before carrying out analysis. From the IHDS individual database, the following have been excluded.

a) Analysis of chronic diseases such as diabetes, cancer and heart diseases was restricted to population aged 22 years or above as the prevalence of these diseases is almost negligible in ages less than 22 years. The analysis of risk factors is also limited to people aged 22 years or more (adults).

b) For marital status, all categories other than married, single, widowed and separated / divorced have been excluded from analysis.

c) With regards to the diseases diabetes, cancer and heart, a very small number of respondents were classified as 'cured' in the database. These are excluded from analysis.

d) In the IHDS data, individuals have responded one of "Never, Sometimes or Daily" when asked about their frequency of tobacco smoking. The second response is ambiguous and does not quantify frequency of tobacco consumption. "Sometimes" category of tobacco smokers has been excluded from the analysis.

Data cleaning :

Data cleaning has been done for height and weight data. Weight less than 35 kg or more than 150 kg have been discarded from the variables 'weight1' and 'weight 2' of IHDS database. For cleaning height data, values less than 121.9 cm (i.e. 4 ft) have been discarded. In the context of India, these extremes appear improbable.

After exclusions and data cleaning from individual dataset of IHDS (2005), 1,16,255 cases are analyzed.

Construction of new variables :

Some variables needed for the analysis are not included in the IHDS (2005) database. These have been constructed in order to proceed with the analysis. For example BMI (Body Mass Index) is one of the risk factors of chronic disease. As this variable is not included in individual IHDS data, the same has been constructed. This is

possible because individual height and weight data is available. Information on familial food consumption such as edible oil, milk product and non veg (non vegetarian) are available in household dataset of IHDS (2005). Information of household size is also available in it. Using these, per capita edible oil consumption, per capita milk product consumption and per capita non veg consumption for each family have been computed. These have then been exported to the individual database of IHDS (2005). Thereafter quartiles have been constructed for each of these diet related variables.

Recoding of variables :

Some of the scale variables have been categorized and some of the categorized variables have been further recategorised as follows.

(i) BMI is coded as Underweight (BMI<18.5 kg/m^2), Normal Weight (18.5 kg/m^2<BMI<24.99 kg/m^2) and Overweight (BMI>25 kg/m^2).These categories are used worldwide.

(ii) Age is classified into two categories viz. between 22 to 40 years, above 40 years of age.

(iii) For each family in the survey, its total edible oil consumption per month is reported. The same when divided by household size provided per capita consumption– each adult member of the household can hence be assumed to consume that amount of edible oil per month. Quartiles of the same are computed. Each respondent of the individual dataset is then classified to belong to a particular quartile class. The constructed variable "familial per capita edible oil consumption" is classified into four categories viz. less than 1^{st} quartile, 1^{st}-2^{nd} quartile, 2^{nd}-3^{rd} quartile and 3^{rd} -4^{th} quartile. The quartile boundaries are less than 0.39999 litres per month, between 0.4000 litres to 0.5713999 litres per month, between 0.5714 litres to 0.83332999 litres per month and 0.8333 litres through highest per month.

(iv) Per capita milk product consumption per family is categorized in a manner similar to (iii) above. The quartile boundaries are less than 0.2221999 kg per month, between 0.2222 kg to 0.39999 kg per month, between 0.4000 kg to 0.85700009 kg per month, 0.8571 kg through highest per month. Milk product consumption includes butter, cream, curd, paneer, ghee etc.

(v) Per capita non veg consumption is also classified into four categories similar to (iii) above. The quartile boundaries are less than 0.24999 kg per month, between

0.2500 kg to 0.49999 kg per month, between 0.5000 kg to 0.79999 kg per month, 0.8000 kg through highest per month. Non veg consumption includes consumption of meat and fish.

RESULTS AND DISCUSSION

Logistic Regression analysis of heart disease :

Table 1 presents logistic regression analysis with respect to different modifiable risk factors.

Table 1: Results of Logistic Regression Analysis for heart diseases.

Variables	B	SE	p- value	Odds Ratio	95% C.I. for Odds Ratio	
					Lower	Upper
Tobacco Smoke Dail	0.284	0.166	0.088**	1.329	0.959	1.841
Never®						
BMI Normal weight	0.155	0.223	0.487	1.168	0.754	1.808
Overweight	0.330	0.240	0.168	1.391	0.870	2.226
Underweight®						
High BP Yes	-0.062	0.081	0.446	0.940	0.802	1.102
No®						
Edible oil consumption 1^{st}-2^{nd} quartile	-0.073	0.120	0.544	0.930	0.734	1.177
2^{nd}-3^{rd} quartile	0.076	0.113	0.502	1.079	0.864	1.348
3^{rd}-4^{th} quartile	0.447	0.105	0.000*	1.563	1.272	1.920
Less than 1^{st} quartile®						

(Cont...)

Milk product consumption 1st-2nd quartile	0.157	0.188	0.403	1.170	0.810	1.691
2nd-3rd quartile	0.150	0.180	0.406	1.161	0.816	1.654
3rd-4th quartile	-0.061	0.181	0.736	0.941	0.659	1.343
Less than 1st quartile®						
Non veg consumption 1st-2nd quartile	0.292	0.179	0.103	1.339	0.943	1.901
2nd-3rd quartile	0.135	0.188	0.475	1.144	0.791	1.656
3rd-4th quartile	0.509	0.172	0.003*	1.664	1.189	2.329
Less than 1st quartile®						

* denotes 5% level of significance
** denotes 10% level of significance
® denotes reference category

For the attribute 'tobacco smoking', two categories have been considered--daily smokers and others as non smokers. From table 1, it can be observed that tobacco smoking and the prevalence of heart disease are weakly significant (p value= 0.088). This may appear to be surprising. However, Vishwanathan et al. (2001) did not observe any significant association between smoking and coronary artery disease. An increased odds ratio of 1.329 suggests that smokers are more likely to be susceptible to heart disease as compared to non smokers. Similar observation was obtained by Sumartono and Herawati (2010).

Another objective is to examine if there is any association between BMI and prevalence of heart disease. The p value indicates that BMI and prevalence of heart disease are not significantly associated. However odds ratio indicates that normal weight and overweight persons are 1.168 and 1.391 times more likely to have heart diseases than underweight persons. Some studies have reported that

there is no association between BMI and the risk of coronary heart diseases in both men and in women (Beard et al., 1999; Thompson et al., 1999). In the context of India, it has been suggested that waist to hip ratio is perhaps a better predictor of heart disease.

There is no significant association between heart disease and high BP and it may be inferred that possibly prevalence of heart disease is not affected by high BP. It has been suggested that high BP is the most important cardiovascular risk factor, contributing to one half of the coronary heart diseases and two third of the stroke (Khan et al., 2010). The results here differs from Khan et al. (2010) perhaps due the fact that data relating to stroke is not available in IHDS database. Thus analysis was carried out with heart disease only.

For the variable 'per capita edible oil consumption', considered four categories have been considered viz. less than 1^{st} quartile, 1^{st}-2^{nd} quartile, 2^{nd}-3^{rd} quartile and 3^{rd}-4^{th} quartile taking less than 1^{st} quartile as the reference category. 1^{st}-2^{nd} and 2^{nd}-3^{rd} quartile class per capita edible oil consumption are not significant with heart disease whereas highest quartile i.e 3^{rd}-4^{th} quartile edible oil consumption is highly significant with heart disease (p value=0.000). Persons belonging to highest quartile of edible oil consumption are about 1.6 times more likely to develop heart disease than than those who fall in the lowest edible oil consumption class. Gebauer et al. (2007) pointed out that vanaspati contains large amounts of trans fatty acids which are reported to be the risk factors for the development of coronary heart disease Many studies have shown that TFA intake is associated with increased risk of CHD (Oomen et al., 2001; Fernandez-San Juan, 2009; Lichtenstein, 2000; Mozaffarian et al., 2007).

Looking at the p value from table 1, it may be concluded that different categories of per capita milk product consumption are not significant with the prevalence of heart disease.

Interpretation of per capita non veg consumption is similar to that of per capita edible oil consumption. Here also, 1^{st} -2^{nd} and 2^{nd}-3^{rd} quartile class per capita non veg consumption are not significant with heart disease whereas highest quartile i.e 3^{rd}-4^{th} quartile edible oil consumption are significant with heart disease (p value=0.003).

Logistic Regression analysis of diabetes :

Table 2: Results of Logistic Regression Analysis for diabetes

Variables	B	SE	p- value	Odds Ratio	95% C.I. for Odds Ratio	
					Lower	Upper
Tobacco Smoke Daily	-0.163	0.128	0.205	0.850	0.661	1.093
Never®						
BMI Normalweight	1.282	0.375	0.001*	3.603	1.728	7.514
Overweight	2.105	0.375	0.000*	8.205	3.931	17.123
Underweight®						
High BP Yes	0.548	0.060	0.000*	1.730	1.539	1.945
No®						
Edible oil consumption 1st-2nd quartile	0.631	0.112	0.000*	1.879	1.509	2.341
2nd-3rd quartile	0.911	0.106	0.000*	2.488	2.020	3.064
3rd-4th quartile	1.026	0.104	0.000*	2.789	2.275	3.418
Less than 1st quartile®						
Milk product consumption 1st-2nd quartile	0.047	0.171	0.784	1.048	0.750	1.464
2nd-3rd quartile	0.332	0.155	0.033*	1.394	1.028	1.889
3rd-4th quartile	0.324	0.152	0.033*	1.382	1.027	1.860

(Cont...)

Less than 1st quartile® Non veg consumption 1st-2nd quartile	0.618	0.168	0.000*	1.854	1.335	2.576
2nd-3rd quartile	0.691	0.170	0.000*	1.996	1.429	2.786
3rd-4th quartile	1.167	0.159	0.000*	3.213	2.353	4.387
Less than 1st quartile®						

* denotes 5% level of significance
® denotes reference category

From table 2, it may be observed that there is no significant association between smoking and prevalence of diabetes. Thus it may be concluded that both smokers and non smokers may have equal chance of having diabetes. Non significant association between smoking and prevalence of diabetes was also reported by Aekplakorn et al. (2006) and Patil et al. (2011).

Compared to the reference category 'underweight', overweight people are approximately eight times more likely to be susceptible to diabetes. For normal weight people, an increased odd ratio of 3.603 suggests that they are 3.6 times more likely to have diabetes as compared to the reference category stated earlier. Ni Mhurchu et al. (2006) in their study found evidence of a strong continuous association between BMI and diabetes in the Asia Pacific region. Similar finding were obtained by Majgi et al. (2012) and Corsi and Subramanian (2012).

From table 2, it is seen that there is highly significant association between high BP and the prevalence of diabetes. Persons having high BP are more susceptible to have diabetes (odds ratio=1.730) than those who do have high BP. The fact that hypertension and diabetes was statistically significant has been reported by Singh et al. (2011).

Edible oil consumption has been categorized into four categories. A highly significant relationship can be observed between 1st-2nd, 2nd-3rd, 3rd-4th quartiles edible oil consumption and prevalence of diabetes. Compared to the reference category 'less than 1st quartile edible oil consumption', all the other upper quartiles show increased odds ratios which suggest that persons belonging to 1st-2nd, 2nd-3rd and 3rd-4th quartiles edible oil consumption are more likely to have diabetes as compared to the reference category. Similar results hold for non veg consumption and

prevalence of diabetes. The fact that higher consumption of trans fatty acid was associated with increased risk of type 2 diabetes had been reported by Pisabarro et al. (2004).

1st -2nd quartile milk product consumption is not significant with diabetes whereas 2nd-3rd and 3rd-4th quartile milk product consumption are significant with diabetes (p value=0.033 for both categories).

Logistic Regression analysis of cancer :

Table 3: Results of Logistic Regression Analysis for cancer

Variables	B	SE	p- value	Odds Ratio	95% C.I. for Odds Ratio	
					Lower	Upper
Tobacco Smoke Daily	0.761	0.415	0.067**	2.139	0.948	4.827
Never®						
BMI Not Underweight	-0.429	0.580	0.459	0.651	0.209	2.029
BMI : Underweight®						
High BP Yes	-0.769	0.280	0.006*	0.463	0.267	0.803
High BP : No®						
Edible oil consumption 1st-2nd quartile	0.170	0.312	0.585	1.185	0.643	2.185
2nd-3rd quartile	-0.099	0.322	0.759	0.906	0.482	1.703
3rd-4th quartile	-0.091	0.315	0.772	0.913	0.492	1.692
Less than 1st quartile®						
Milk product consumption 1st-2nd quartile	0.003	0.560	0.996	1.003	0.335	3.003

(Cont...)

2nd-3rd quartile	0.318	0.496	0.521	1.375	0.520	3.635
3rd-4th quartile	-0.037	0.521	0.943	0.964	0.347	2.673
Less than 1st quartile®						
Non veg consumption 1st-2nd quartile	-0.508	0.489	0.299	0.602	0.231	1.569
2nd-3rd quartile	-0.238	0.475	0.616	0.788	0.311	1.999
3rd-4th quartile	-1.282	0.603	0.546	0.719	0.285	1.905
Less than 1st quartile®						

* denotes 5% level of significance
** denotes 10% level of significance
® denotes reference category

From table 3, it can be observed that tobacco smoke and cancer is weakly significant (p value= 0.067). Odd ratio of 2.139 suggests that daily smokers are more prone to have cancer than non smokers. Xie et al. (1999) found smoking to have no effect on cancer incidence.

BMI and prevalence of cancer are not significantly associated (p value=0.459). The result differs from Renehan et al. (2008) who concluded that increased BMI is associated with the risk of some common adult cancers.

A significant association can also be observed between high BP and prevalence of cancer (p value=0.006). Xie et al. (1999) concluded that hypertension is associated with a high risk of cancer. From table 3, it can be observed that odds ratio is 0.463 which suggest that persons having high BP are less likely to have cancer than those who do not have high BP. According to Jiang et al. (2010), compared with individuals without hypertension, untreated hypertensive subjects had a 35% reduction in bladder cancer risk (OR: 0.65; 95% CI: 0.48–0.88).

Observing p value, it can be concluded that different categories of edible oil, milk product and non veg consumption are not significant with the prevalence of cancer. Vanaspati contains large amount of trans fatty acids which are reported to be the risk factors involved in cancer (Gebauer et al., 2007). Hence the results here regarding edible oil differ from that of Gebauer et al. (2007). Several systematic reviews on the relation between dairy products and cancer was conducted by World

Cancer Research Fund team in 2007 (Wiseman, 2008). They concluded that there was no association between milk and dairy products and cancers of, for example, lung, stomach, and breast.

Thus, it can be concluded that diet does not play any role for the development of cancer. In the words of Wascher (2010), “The role of diet in the development of cancer is an enormously complex area of research, and much of the data within this huge field of clinical study remains inconsistent and contradictory, unfortunately.”

Comparison between models :

So far the influence of modifiable risk factor on three chronic diseases has been examined. It would be interesting to examine if the influence of modifiable risk factors varies among categories of non modifiable risk factors. Two such factors were selected for this purpose viz. age and urbanisation. Performing cross tabulation over age groups and heart disease, it can be seen that the chance of heart disease is 50% higher in the 41 and above age group compared to the 22-40 age group (Table 4). Similarly it is more than three times in case of diabetes (Table 5). Similarly performing cross tabulation over urbanisation and heart disease, it can be seen that chance of occurring heart disease is almost double for people residing in urban area than that of people residing in rural area (Table 6). Similar results have been obtained by performing cross tabulation of urbanisation and diabetes (Table 7). In view of these findings, it is not of interest to examine if there is any significant differences between modifiable risk factors and heart disease and diabetes over age groups and place of residence. Nothing similar was observed for age and cancer and also for urbanisation and cancer.

Table 4. Crosstab between age group and heart disease

Age Group	Heart Disease	
	No	Yes
22-40	92.8%	7.2%
41 and above	88.8%	11.2%

Table 5. Crosstab between age group and diabetes

Age Group	Diabetes	
	No	Yes
22-40	93.3%	6.7%
41 and above	79.9%	20.1%

Table 6. Crosstab between place of residence and heart disease

Place of residence	Heart Disease	
	No	Yes
Rural	92.1%	7.9%
Urban	86.6%	13.4%

Table 7. Crosstab between place of residence and diabetes

Place of residence	Diabetes	
	No	Yes
Rural	88.1%	11.9%
Urban	76.9%	23.1%

As stated earlier, a comparison of the influence of modifiable risk factors on heart disease and diabetes among different age groups and place of residence will be of interest (cancer has been excluded as the crosstabulation did not yield anything significant). For this purpose, logistic regression of modifiable risk factors on heart disease and diabetes were carried out separately and individually in the two age groups (22-40 and 41 and above) and place of residence (urban/rural).

Two pairs of comparisons are to be made. In the first pair, 1st model refers to '22-40' age group and 2nd model to '41 and above' age group. In the second pair, 1st model refers to 'rural' and 2nd model to 'urban'.

The p values of the Wald statistic for all modifiable risk factors considered for the study are presented in tables 8, 9, 10 and 11.

From table 8, it can be observed that the p values of Wald statistic are significant w.r.t high BP and edible oil consumption. This indicates that the influence of these two risk factors on heart disease are significantly different in the two age groups 22-40 and 41 and above. However there is no significant difference in the influence of modifiable risk factors on diabetes for the two age groups 22-40 and 41 and above (Table 9).

From table 10, high BP is observed to be significant. It indicates that the influence of this modifiable risk factor on heart disease is significantly different according to place of residence (rural/urban). From table 11, high BP, edible oil consumption and non veg consumption are significantly different in respect of their influence on diabetes for different place of residence (rural/urban). This indicates that these modifiable risk factors influence diabetes differently in respect of place of residence (rural/urban).

Table 8. Results of logistic regression analysis of modifiable risk factors on heart disease for different age groups.

Modifiable Risk Factors	Age group : 22-40		Age group : 41 and above		p value of Wald Statistic
	B	SE	B	SE	
Tobacco Smoke	0.505	0.418	0.237	0.182	0.557
BMI Normal weight	0.143	0.269	0.084	0.408	0.904
Overweight	0.211	0.309	0.293	0.415	0.874
High BP	-0.665	0.276	-0.069	0.087	0.039*
Edible oil consumption Ist-2nd	-0.287	0.218	0.020	0.146	0.242
2nd-3rd	-0.698	0.238	0.307	0.135	0.000*
3rd-4th	-0.163	0.220	0.593	0.126	0.003*
Milk Product consumption Ist-2nd	0.404	0.427	0.086	0.210	0.504
2nd-3rd	-0.604	0.451	0.175	0.198	0.628

(Cont...)

3rd-4th	-0.144	0.451	-0.073	0.199	0.885
Non veg consumption Ist-2nd	0.562	0.321	0.161	0.216	0.300
2nd-3rd	-0.273	0.395	0.208	0.219	0.287
3rd-4th	0.063	0.374	0.533	0.200	0.268

* denotes 5% level of significance

Table 9. Results of logistic regression analysis of modifiable risk factors on diabetes for different age groups.

Modifiable Risk Factors	Age group : 22-40		Age group : 41 and above		p value of Wald Statistic
	B	SE	B	SE	
Tobacco Smoke	0.410	0.405	-0.245	0.137	0.126
BMI Normal weight	1.348	0.530	0.987	0.536	0.632
Overweight	1.939	0.541	1.789	0.532	0.843
High BP	0.439	0.202	0.407	0.064	0.880
Edible oil consumption Ist-2nd	0.736	0.295	0.559	0.122	0.579
2nd-3rd	0.740	0.290	0.877	0.116	0.661
3rd-4th	1.058	0.287	0.885	0.113	0.575
Milk Product consumption Ist-2nd	0.555	0.457	-0.059	0.186	0.213
2nd-3rd	0.480	0.442	0.302	0.168	0.707
3rd-4th	0.557	0.431	0.265	0.164	0.527

(Cont...)

Non veg consumption Ist-2nd	0.650	0.435	0.553	0.184	0.835
2nd-3rd	0.689	0.449	0.611	0.187	0.873
3rd-4th	1.051	0.434	1.029	0.174	0.962

Table 10. Results of logistic regression analysis of modifiable risk factors on heart disease for different place of residence

Modifiable Risk Factors	Age group : 22-40		Age group : 41 and above		p value of Wald Statistic
	B	SE	B	SE	
Tobacco Smoke	0.100	0.212	0.602	0.272	0.145
BMI Normal weight	0.254	0.268	-0.226	0.412	0.329
Overweight	0.409	0.334	-0.078	0.411	0.358
High BP	-0.019	0.132	-0.321	0.105	0.073**
Edible oil consumption Ist-2nd	-0.174	0.157	-0.105	0.194	0.782
2nd-3rd	-0.018	0.153	-0.075	0.180	0.809
3rd-4th	0.342	0.141	0.269	0.169	0.740
Milk Product consumption Ist-2nd	0.141	0.263	0.149	0.270	0.983
2nd-3rd	-0.212	0.277	0.349	0.247	0.131
3rd-4th	-0.187	0.257	0.064	0.259	0.492
Non veg consumption Ist-2nd	0.437	0.260	0.044	0.251	0.277

Continued

2nd-3rd	0.266	0.281	-0.180	0.258	0.242
3rd-4th	0.686	0.250	0.205	0.240	0.165

** denotes 10% level of significance

Table 11. Results of logistic regression analysis of modifiable risk factors on diabetes for different places of residence

Modifiable Risk Factors	Age group : 22-40		Age group : 41 and above		p value of Wald Statistic
	B	SE	B	SE	
Tobacco Smoke	-0.171	0.175	-0.112	0.194	0.821
BMI Normal weight	1.142	0.441	1.295	0.736	0.858
Overweight	1.966	0.465	1.920	0.730	0.958
High BP	0.989	0.090	-0.024	0.080	0.000*
Edible oil consumption Ist-2nd	0.751	0.154	0.261	0.167	0.031*
2nd-3rd	1.006	0.150	0.436	0.156	0.008*
3rd-4th	1.059	0.149	0.546	0.151	0.016*
Milk Product consumption Ist-2nd	0.056	0.262	-0.011	0.230	0.848
2nd-3rd	0.213	0.246	0.303	0.207	0.780
3rd-4th	0.219	0.233	0.417	0.206	0.524
Non veg consumption Ist-2nd	0.981	0.302	0.296	0.214	0.064**
2nd-3rd	1.441	0.299	-0.025	0.220	0.000*
3rd-4th	2.229	0.280	0.099	0.212	0.000*

* denotes 5% level of significance
** denotes 10% level of significance

CONCLUSION

Although it is known that both modifiable and non modifiable factors influence chronic diseases, the interest is on influence of modifiable risk factors since such risk factors are controllable. This is important as unlike non modifiable risk factors (like age), a person can control one's life style according to one's assessment of the modifiable risk factors unfavourable to him / her. In this paper, three regression analyses have been constructed for heart disease, diabetes and cancer separately with respect to modifiable risk factors. Some of the findings are consistent with previous finding existing in literature. Tobacco smoking was found to be weakly significant for cancer and heart disease whereas it was found to be not significant with diabetes. BMI was found to be significant with diabetes but not with cancer. BMI was not found to be associated with cancer. High BP was found to be highly significant with diabetes (p value=0.000), significant with cancer (p value=0.006) and not significant with heart disease (p value=0.446). Edible oil and non veg consumption were significantly associated with the prevalence of heart disease only in the highest quartile whereas categories of milk product consumption show no significant association. In case of diabetes, highly significant association can be observed for different categories of edible oil and non veg consumption whereas for milk product consumption, significant association can be observed in 2^{nd}-3^{rd} and 3^{rd}-4^{th} quartile class. Diet related variables are not significant with the prevalence of cancer.

To sum up, this analysis points to the importance of diet and lifestyle behaviours in order to be able to cope with the burgeoning epidemic of chronic diseases. This study which is based on a large scale countrywide survey makes a humble point here. There is no alternative to confronting the largely silent epidemic of chronic diseases by adopting preventive measures.

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