Factors Responsible for Obesity Heart Diseases Among Bangladeshi Adults

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Abstract
The aim of this paper was to observe the influencing socioeconomic variables in enhancing the obesity and heart disease simultaneously among Bangladeshi adults of 18 years and above. The adults were interviewed from different urban and semi-urban diagnostic clinics by some nurses with the help of medical assistants working in the clinics when the adults were visiting the clinics for suggested blood test. The number of investigated adults was 995, out of which 51.1% were males. The percentage of obese adults was 30.2 and heart problem was prevailed among 21.7% of them. These latter groups of adults were classified by levels of different socioeconomic variables to observe the association of the variables with the prevalence of obesity-heart disease. The risk ratio for this prevalence for a particular level of socioeconomic variable was calculated along with confidence interval of risk ratio. The influencing variable for the prevalence of obesity-heart problem was detected by logistic regression analysis. The responsible variables were residence, gender, age, family income, smoking habit, sedentary activities and blood pressure. However, non-involvement in physical labour, habit of taking process food and family expenditure were significantly associated with prevalence of obesity-heart disease. The higher risk of prevalence of obesity –heart disease was noted among urban residents, housewives, adults of ages 40-60 years, smokers, process food consumers and among hypertensive adults.

Keywords: Obesity, Heart disease, Responsible variable for obesity-heart problem, Risk ratio, Logistic regression.

Abbreviation: B.P. = Blood Pressure; BMI=Body Mass Index; C.I. = Confidence Interval; R.R. = Risk Ratio.

Introduction
Overweight and Obesity are the risk factors for many chronic non-communicable diseases, specially, diabetes, elevated blood pressure, high cholesterol, and many other poor health conditions [1-2]. The prevalence of overweight and obesity has increased rapidly over the last decades especially in developed countries [3-5]. Again, prevalence of obesity is the risk factor for cardiovascular diseases [heart attack, stroke, etc.]. Obesity related health-risk factors were studied in both home and abroad [6]. The prevalence of obesity was increasing in many countries due to upward social mobility and the problem was shifting towards lower socio economic group of people [7]. The problem of obesity was also in increasing trend in developed countries [8-9]. In 2016, WHO reported that the overweight adults were 1.9 billion and obese adults were 650 million throughout the world [10]. Simultaneous occurrence of obesity and hypertension in the same individual doubles the risk of cardiovascular deaths [11]. Obesity and its associated cardiovascular and renal disorders are major threat to global health [12-13]. The problem is nearly doubled since 1980 and tripled since 1975.

Thus, World Health Organization considers this health hazard as an epidemic worldwide and it needs public health intervention to control those factors which are associated with obesity and hence with diabetes [14]. It had been observed in some studies, both in home and abroad, that socioeconomic characteristics, like financial solvency, change of food habit towards fast food and can food; physical inactivity, sedentary activity like excessive use of mobile phone and television, etc. were the responsible factors for obesity and diabetes [15-18]. Beside these, some other socioeconomic factors like illiteracy, gender variation, residential origin, occupation, marital status, were also associated with obesity and hence with obesity related diseases [19-22].

From the above discussion it is clear that the epidemic of obesity and obesity related non-communicable diseases are alarmingly increasing among different groups of people, specially, among adults. Thus, it was decided to identify some responsible variables for simultaneous prevalence of obesity heart disease among Bangladeshi adults.

Methodology
The adults were interviewed by quota sampling plan to cover males and females in the ratio 50.1: 49.9 as this ratio is prevailed in the national
level of population [23]. The data were collected during the academic session 2018-19 by some nurses with the help of medical assistants working in some diagnostic centres in some purposively selected urban and semi-urban areas of Bangladesh. The sample respondents were of ages 18 years and above and were the residents of both urban and rural localities. The data were recorded through a pre-designed and pre-tested questionnaire which contains different questions on demographic characteristics and life-style of the respondents. Data on family income and family expenditure were also recorded from each respondent. The total investigated adults were 995, out of which 508 were males and 487 were females.

Some of the variables were qualitative in nature, but all the variables were noted in nominal scale for ease of analysis. The data of weight (in kg) divided by Height (in m²) was used to measure the value of body mass index (BMI) to identify obese adults (if BMI ≥ 27.5; overweight, if BMI< 18.5;normal, if 18.5 ≤BMI< 23.0; overweight, if BMI ≤ 23.0). They were also divided into 4 groups according to their blood pressure (B.P) level (mmHg). The 4 groups were identified as optimal (if BP < 120/80), normal (if BP ≥ 130/85), high normal (if BP ≥ 140/90) and hypertensive (if BP ≥ 140/90) [26].

According to the objective of the study, the association of each socioeconomic variable with simultaneous prevalence of obesity heart disease was investigated, where significant association was decided if p-value of any Chi-square statistic was less than or equal to 0.05. Irrespective of significant or insignificant association, the risk ratio was calculated for adults for whom prevalence of obesity-heart problem was noted in higher rate for a particular level of a socioeconomic variable. Finally, logistic regression analysis was performed to identify the significant impact of a variable on prevalence of obesity-heart disease. All the calculations were done using SPSS Version 25.

Results

The number of investigated adults was 995, out of which 30.2% were obese, 12.7% were suffering from heart disease. Among obese adults 21.7 had heart problem. The percentage of adults of heart problem was increasing when the level of body mass index exceeded normal level. Health problem was significantly associated with level of obesity as was observed by Chi-square test \( \chi^2 = 275.875, p -value = 0.000 \), Table 1. It was seen that prevalence of obesity-heart problem was observed among 65 (6.5%) respondents and 930 were free of these health problems [Table2]. According to objective of the study the impacts of different levels of socioeconomic characteristics of these 65 respondents were studied.

### Table 1: Distribution of adults according to the level of obesity and prevalence of the health problem

| Health problem | Underweight | Normal | Overweight | Obesity | Total |
|----------------|-------------|--------|------------|---------|-------|
|                | Number | %     | Number | %     | Number | %     | Number | %     | Number | (%) |
| None            | 33     | 86.8  | 181    | 77.7  | 324    | 76.4  | 68     | 22.7  | 606    | 60.9 |
| Heart           | 3      | 7.9   | 16     | 6.9   | 42     | 9.9   | 65     | 21.7  | 126    | 12.7 |
| Eye             | 1      | 2.6   | 22     | 9.4   | 25     | 5.9   | 75     | 25.0  | 123    | 12.4 |
| Kidney          | 1      | 2.6   | 10     | 4.3   | 19     | 4.5   | 62     | 20.7  | 92     | 9.2  |
| Others          | 0      | 0.0   | 4      | 1.7   | 14     | 3.3   | 30     | 10.0  | 48     | 4.8  |
| Total           | 38     | 3.8   | 233    | 23.4  | 424    | 42.6  | 300    | 30.2  | 995    | 100.0|

Among the respondents 46.6% were from urban areas and 7.5% of them were the patients of obesity- heart problem. This proportion was higher than the overall proportion of obese and heart patients in the sample. However, there was no significant difference in the proportions of obese-heart patients in rural and urban localities \( \chi^2=1.454, p-value=0.228 \). But the chance to be affected by obesity-heart problem by urban residents was 1.34 times than it was among rural adults \[R.R. = 1.34, C.I. \{0.836, 2.149\}\]. The female respondents were 49.9% and 6.6% of them were suffering from obesity heart problem. The number of investigated adults was 995, out of which 30.2% were obese, 12.7% were suffering from heart disease. Among obese adults 21.7 had heart problem. The percentage of adults of heart problem was increasing when the level of body mass index exceeded normal level. Health problem was significantly associated with level of obesity as was observed by Chi-square test \( \chi^2 = 275.875, p -value = 0.000 \), Table 1. It was seen that prevalence of obesity-heart problem was observed among 65 (6.5%) respondents and 930 were free of these health problems [Table2]. According to objective of the study the impacts of different levels of socioeconomic characteristics of these 65 respondents were studied.

The percentage of sample respondents of ages 25 to less than 40 years was 40.3 and they were the largest group of adults and 6.5% of them were the patients of obesity-heart disease. The next higher group (20.4%) of adults was in the age group 40 to less than 50 years.
and 10.8% of them were affected by this health hazard. Biggest affected group (12.3%) of adults were of ages 50 to less than 60 years. It was seen that with the increase in ages there was an increasing trend of affected adults from the obesity heart problem except in case of adults of 60 years and above. Significant differences in the proportions of prevalence of obesity-heart problem were noted for adults of different ages ($\chi^2 = 11.593$, $p$-value= 0.021). The chance of prevalence was 1.82 times among adults of ages 40 to less than 60 years compared to that of others [R.R. = 1.82, C.I. [1.139, 2.907]]. Most of the adults (81.3%) were at least secondary level educated and 7.4% of them were the patients of obesity-heart problem and the chance of prevalence of this health hazard in them was 2.76 times as it was in others [R.R. = 2.76, C.I. [1.125, 6.773]]. But the prevalence of obesity-heart problem was not significantly different for adults of different levels of education ($\chi^2 = 6.136$, $p$-value= 0.105). Only secondary level educated respondents were 23.8% and the prevalence of this health hazard was noted among 8.4% of them. The chance of prevalence of obesity-heart problem among them was 1.42 times compared to the chance in others [R.R. = 1.42, C.I. [0.856, 2.355]]. Majority of the respondents were service persons and skilled labours (30.7%) but lowest proportion (4.9%) of them was affected by this health hazard. Highest proportion of affected respondents (8.3%) was noted among housewives. They were 23.1% in the sample and 37% more exposed to this health problem compared to the affected persons of other professions [R.R. = 1.37, C.I. [0.821, 2.289]]. However, significant variation in the proportions of affected adults of different occupation was not observed ($\chi^2 = 3.168$, $p$-value=0.530).

The sample respondents were classified into four groups according to their family income. In highest income (taka 150 thousand and above) group there were 12.6% respondents and 13.6% of them were the patients of obesity-heart. The chance of prevalence of obesity heart problem among them was 2.46 times as it was in other respondents [R.R. = 2.46, C.I. [1.463, 4.152]]. The next highest affected group of respondents (11.5%) belonged to the families having income taka 100 thousand to taka less than 150 thousand. There was an increasing trend in the proportions of affected persons with the increase in family income. The prevalence of this health problem was significantly associated with family income ($\chi^2 = 19.164$, $p$-value=0.000). Similar increasing trend in proportions of affected persons was observed in respondents of families having increasing level of expenditure. Highest affected adults (11.2%) belonged to families spending taka 80 thousand and above. The respondents of this group of families were 13.5%. These group of respondents was 93% more exposed to this health problem compared to that of others [R.R. =1.93, C.I. [0.985, 4.438]]. The percentage of adults of families spending taka 60 thousand and above but less than taka 80 thousand was 14.4 and 10.5 % of them were the patients of obesity heart disease. The less affected adults (in percentage) were noted in families spending less than taka 60 thousand as family expenditure. Significant association between prevalence of obesity heart problem and family expenditure was observed ($\chi^2 =13.832$, $p$-value = 0.003).

Table 2: Distribution of adults according to socioeconomic characteristics and prevalence of obesity heart disease

| Socioeconomic Characteristics | Prevalence of obesity heart disease | Total |
|------------------------------|-----------------------------------|-------|
|                              | Yes | No | Number | % | % | Number | % |
| Residence                    |     |    |        |   |   |        |   |
| Rural                        | 30  | 5.6| 501    | 94.4| 531| 53.4   |
| Urban                        | 35  | 7.5| 429    | 92.5| 464| 46.6   |
| Total                        | 65  | 6.5| 930    | 93.5| 995| 100.0  |
| Gender                       |     |    |        |   |   |        |   |
| Male                         | 32  | 6.4| 466    | 93.6| 498| 50.1   |
| Female                       | 33  | 6.6| 464    | 93.4| 497| 49.9   |
| Religion                     |     |    |        |   |   |        |   |
| Muslim                       | 54  | 6.4| 794    | 93.6| 848| 85.2   |
| Non-Muslim                   | 11  | 6.6| 136    | 93.4| 147| 14.8   |
| Marital status               |     |    |        |   |   |        |   |
| Currently married            | 61  | 6.6| 865    | 93.4| 926| 93.1   |
| Currently single             | 4   | 5.8| 65     | 94.2| 69 | 6.9    |
| Age (in years)               |     |    |        |   |   |        |   |
| < 25                         | 5   | 2.6| 191    | 97.4| 196| 19.7   |
| 25 - 40                      | 26  | 6.5| 375    | 93.5| 401| 40.3   |
| 40 - 50                      | 22  | 10.8| 181    | 89.2| 203| 20.4   |
| 50 - 60                      | 8   | 12.3| 107    | 87.7| 115| 11.6   |
|                      | Number | %       | Number | %       | Number | %       |
|----------------------|--------|---------|--------|---------|--------|---------|
| Education            |        |         |        |         |        |         |
| Illiterate           | 2      | 3.1     | 63     | 96.9    | 65     | 6.5     |
| Primary              | 3      | 2.5     | 118    | 97.5    | 121    | 12.2    |
| Secondary            | 20     | 8.4     | 217    | 91.6    | 237    | 23.8    |
| Higher               | 40     | 7.0     | 532    | 93.0    | 572    | 57.5    |
| Occupation           |        |         |        |         |        |         |
| Agriculture and      | 6      | 5.8     | 98     | 94.8    | 104    | 10.5    |
| unemployed           |        |         |        |         |        |         |
| Business             | 18     | 7.7     | 139    | 86.3    | 234    | 23.5    |
| Service and skilled  | 15     | 4.9     | 185    | 86.9    | 305    | 30.7    |
| labor                |        |         |        |         |        |         |
| Housewives           | 19     | 8.3     | 284    | 85.8    | 230    | 23.1    |
| Retire               | 7      | 5.7     | 115    | 94.3    | 122    | 12.3    |
| Income (000 taka)    |        |         |        |         |        |         |
| < 50                 | 13     | 3.3     | 376    | 96.7    | 389    | 39.1    |
| 50 – 100             | 28     | 6.7     | 392    | 93.3    | 420    | 42.2    |
| 100 – 150            | 7      | 11.5    | 54     | 88.5    | 61     | 6.1     |
| 150+                 | 17     | 13.6    | 108    | 86.4    | 125    | 12.6    |
| Family expenditure   |        |         |        |         |        |         |
| (in 000 taka)        |        |         |        |         |        |         |
| < 40                 | 15     | 3.6     | 401    | 96.4    | 416    | 41.4    |
| 40 – 60              | 20     | 6.6     | 282    | 93.4    | 302    | 30.4    |
| 60 – 80              | 15     | 10.5    | 128    | 89.5    | 143    | 14.4    |
| 80+                  | 15     | 11.2    | 119    | 88.5    | 134    | 13.5    |
| Blood pressure       |        |         |        |         |        |         |
| (mmHg)               |        |         |        |         |        |         |
| Optimal              | 7      | 1.3     | 533    | 98.7    | 540    | 54.3    |
| Normal               | 17     | 6.1     | 263    | 93.9    | 280    | 28.1    |
| High normal          | 25     | 21.6    | 91     | 78.5    | 116    | 11.7    |
| Hypertensive         | 16     | 27.1    | 43     | 72.9    | 59     | 5.9     |
| Smoking habit        |        |         |        |         |        |         |
| Yes                  | 53     | 16.1    | 276    | 83.9    | 329    | 33.1    |
| No                   | 12     | 1.8     | 654    | 98.2    | 666    | 66.9    |
| Habit of taking      |        |         |        |         |        |         |
| process food         |        |         |        |         |        |         |
| Yes                  | 32     | 8.8     | 331    | 91.2    | 363    | 36.5    |
| No                   | 33     | 5.2     | 599    | 94.8    | 632    | 63.5    |
| Physical work        |        |         |        |         |        |         |
| Yes                  | 19     | 4.0     | 462    | 96.0    | 481    | 48.3    |
| No                   | 46     | 8.9     | 468    | 91.1    | 514    | 51.7    |
| Involved in sedentary activity |        |         |        |         |        |         |
| Yes                  | 52     | 11.8    | 390    | 88.2    | 442    | 44.4    |
| No                   | 13     | 2.4     | 540    | 97.6    | 553    | 55.6    |
| Prevalence of diabetes |        |         |        |         |        |         |
| Yes                  | 50     | 7.5     | 617    | 92.5    | 667    | 67.0    |
| No                   | 15     | 4.6     | 313    | 95.4    | 328    | 33.0    |
| Total                | 65     | 6.5     | 930    | 93.5    | 995    | 100.0   |
The percentage of adults habituated in taking process food was 36.5 and 8.8% of them were the patients of obesity heart problem. The chance for them to be affected by this health hazard was 1.85 times as it was in others [R.R. = 1.85, C.I. [1.158, 3.159]]. Significant association between prevalence of obesity heart problem and habit of taking process food was observed [\( \chi^2 = 4.877, p-value = 0.027 \)]. Among the adults 33.1% were smokers and 16.1% of them were affected by obesity hypertension. The chance of prevalence of this health problem in them was 8.94 times as it was in non-smokers [R.R. = 8.94, C.I. [4.841, 16.511]]. The smoking habit was significantly associated with prevalence of obesity heart disease [\( \chi^2 = 73.830, p-value = 0.000 \)]. The percentage of adults who did not do any physical work was 51.7 and 8.9% of them were the patients of obesity heart disease. These groups of respondents were at risk of 2.27 times compared to the risk of adults doing any type of physical work. Physical work and prevalence of this health hazard was significantly associated [\( \chi^2 = 10.171, p-value = 0.001 \); R.R. = 2.27, C.C. [1.350, 3.416]]. Among the respondents 44.4% were involved in sedentary activities and 11.8% of them were obese and heart patients simultaneously. The chance of prevalence of this health problem in them was 5.20 times as it was in others. This prevalence of health hazard was significantly associated with utilization of time by the respondents [\( \chi^2 = 35.654, p-value = 0.000 \); R.R. = 5.20, C.I. [2.871, 9.444]].

There were 54.3% adults of optimal blood pressure. Only 5.9% adults were hypertensive and 27.1% of them were the patients of obesity and heart disease. The chance of this health hazard for this group was 5.18 times as it was in others [R.R. = 5.180, C.I. [3.142, 8.539]]. This health hazard was significantly increasing with the increase in level of blood pressure [\( \chi^2 = 108.150, p-value = 0.000 \)]. The percentage of diabetic adults was 67.0 and 7.5% of them were suffering from obesity heart disease. This diabetic group was 54% more exposed to this health problem [R.R. = 1.54, C.I. [0.891, 2.656]]. However, prevalence of diabetes and prevalence of obesity heart disease was not significantly associated [\( \chi^2 = 3.077, p-value = 0.079 \)].

### Logistic Regression

Binary logistic regression model was fitted to identify the influencing variables for the prevalence of obesity heart problem among adults. The dependent variable was prevalence of the problem \( y=1 \) for prevalence and \( y=0 \) for non-prevalence and explanatory variables were residence, religion, gender, marital status, education, occupation, family income, family expenditure, habit of taking process food, smoking habit, utilization of time, physical work, prevalence of diabetes, and blood pressure level. The results of the regression analysis were presented in Table 3.

The results of Hosmer-Lemeshow test gave \( \chi^2=17.810 \) with \( p-value=0.023 \). The value of Nagelkarke R\(^2\)=0.514

From the \( p-value \) of Wald Statistic it was seen that the variables residence, gender, age, smoking habit, utilization of time, and blood pressure were the influencing factors for the prevalence of obesity simultaneously. The values of odds ratio [Exp(B)] indicated that urban residents, females married persons, adults involved in sedentary activity and hypertensive adults were more exposed to this health hazard.

### Discussion

Body mass index is significantly associated with diabetes among Bangladeshi adults and diabetes is the major health hazard among them [27]. Directly or indirectly obesity is the cause of heart disease

| Variable           | Regression coefficient, B | S.E    | Wald Statistic | p-value | Exp(B) |
|--------------------|---------------------------|--------|----------------|---------|--------|
| Residence          | 0.725                     | 0.360  | 4.065          | 0.044   | 2.064  |
| Religion           | 0.339                     | 0.452  | 0.561          | 0.454   | 1.403  |
| Gender             | 1.378                     | 0.482  | 8.195          | 0.004   | 3.969  |
| Marital status     | 0.772                     | 0.616  | 1.568          | 0.210   | 2.164  |
| Age                | -0.060                    | 0.016  | 13.924         | 0.000   | 0.942  |
| Education          | 0.026                     | 0.225  | 0.013          | 0.910   | 1.026  |
| Occupation         | -0.175                    | 0.172  | 1.032          | 0.310   | 0.840  |
| Family income      | 0.000                     | 0.000  | 5.064          | 0.024   | 1.000  |
| Family expenditure | 0.000                     | 0.000  | 0.083          | 0.774   | 1.000  |
| Smoking habit      | -3.287                    | 0.457  | 51.608         | 0.000   | 0.037  |
| Utilization of time| 1.842                     | 0.407  | 20.525         | 0.000   | 6.312  |
| Prevalence of diabetes | -0.479                 | 0.418  | 1.316          | 0.251   | 0.619  |
| Taking process food| -0.678                    | 0.422  | 2.585          | 0.108   | 0.508  |
| Physical labor     | 0.888                     | 0.468  | 3.594          | 0.058   | 8.411  |
| Blood pressure     | 0.238                     | 0.037  | 40.772         | 0.000   | 1.269  |
| Constant           | -19.437                   | 3.271  | 35.317         | 0.000   | -      |

Table 3: Results of Logistic regression
and many other non-communicable diseases including hypertension [28-30]. The risk of Cardiovascular Disease (CVD) increases among adults suffering from obesity hypertension simultaneously. There are many socioeconomic factors responsible for simultaneous prevalence of obesity hypertension and hence CVD. In this paper an attempt was made to identify those factors.

To fulfill the objective of the study 995 adults of ages 18 years and above were interviewed by some nurses with the help of some medical technologists of different diagnostic centers of urban and semi-urban areas to get information from both urban and rural people. The data were recorded from 51.1% males and 49.9% females.

The sample contained 30.2% obese adults and 12.7% patients of heart disease. Among obese adults 21.7% were suffering from obesity and heart disease simultaneously. Percentage of heart disease patients were significantly increasing with the increase in level of body mass index. There were 46.6% urban adults and they were 34% more exposed to the problem of obesity heart disease compared to rural adults. The sample male and female respondents were almost same and there was no association between gender and prevalence of obesity heart problem. Non-Muslim adults were only 14.8%, but they had 1.18 times chance to be affected by this problem compared to Muslim adults.

Most (93.1%) of the adults were currently married and they were more exposed to this health problem. The largest group of adults belonged to age group 25 to less than 40 years. The percentage of affected persons of this group was similar as it was in the sample. However, with the increase in ages there was a significant increase in the percentage of affected respondents and adults of ages 40 years to less than 60 years were more exposed to this health hazard. Similar findings were noted in both home and abroad [31-32]. The respondents having at least secondary level education were more exposed to obesity-heart problem. Usually, housewife does not involved in physical labour directly and they are more exposed to many non-communicable diseases [33]. In the sample 23.1% were housewives and they had 1.37 times chance to be affected by this health problem.

Some non-communicable diseases were termed as lifestyle health hazard [34]. Again lifestyle changes with the change in income and expenditure and these two variables enhance the change in food habit towards process food, can food and fatty and salty foods. Due to change in income and expenditure change in smoking habit and working habit was also noted in some studies [35-37]. The sample observations indicated that upward change in family income enhanced the rate of patients of obesity heart problem. The chance of facing this health problem by the adults belonging to families of highest income level was more compared to that of adults of lower income group of families. Similar was the case with adults belonged to families spending highest amount of money as family expenditure. The prevalence of obesity heart problem was significantly more among adults habituated in process food, and smoking. Also, prevalence was dominant among adults involved in sedentary activities.

Among obese persons diabetes and hypertension are dominant [38]. This study also indicated that prevalence of obesity heart problem was significantly in increasing trend with the increase in blood pressure level. Hypertensive and diabetic adults were more exposed to this health hazard.

**Conclusion**

The objective of the present study was to identify some socioeconomic variables which enhance the obesity-heart problem simultaneously among Bangladeshi adults of 18 years and above residing in both urban and rural localities. Accordingly, 995 adults were investigated and data on different socioeconomic variables from the respondents were noted. The information presented in this paper was the analytical results of those collected data.

In the sample, number of urban and rural respondents was 464 and 531 respectively, and among them 49.9% were females. The males and females were almost similarly exposed to obesity and heart disease simultaneously. The percentage of adults having heart problem was 12.7 and that of obese adults was 30.2 in the sample. Again, 6.5% adults were suffering from both the diseases simultaneously. These groups of adults were classified by different levels of socioeconomic variables and association of prevalence of obesity heart problem with each socioeconomic variable was investigated. The particular level of a variable was identified as responsible for this health hazard if risk ratio for that level was more than one. Responsible variables were also identified by fitting binary logistic regression model.

In fitting the regression model it was noted that residence, gender variation, age, income, smoking habit, sedentary activity and blood pressure were the responsible variables for simultaneous prevalence of obesity heart problem. But from the studies of the association of variable and risk ratio, it was noted that urban adults, adults of ages 40 years and above but less years 60 years, respondents from families of highest income level, smokers, adults involved in sedentary activity and hypertensive respondents were more exposed to the prevalence of obesity heart problem. Beside these variables, housewives, adults of at least secondary level education, diabetic adults, adults habituated in taking process food and physical labour were at higher risk of facing the problem of this health hazard. Due to upward trend in social mobility and economic activity obesity and health hazard cannot be avoided. But there should be some measures to reduce the intensity of this health problem. Government health service providers working in urban and rural areas, social workers, medical practitioners can do a lot to encourage the people so that they can be habituated in leading healthy lifestyle. For this they can be advised to follow the following:

- Do any sort of physical labour so that body weight can be controlled.
- Avoid restaurant food, process food and salty and fatty food.
- Take healthy and homemade food as per possibility.
- Join the blood screening program, whenever it is possible.

**References**

1. Mokdad AH, Ford ES, Bowman BA, Dietz, WH, Vinicor F, et al. “Prevalence of obesity, diabetes, and obesity-related health risk factors 2001”. JAMA 289(2003): 76-79.
2. Barnes AS “The epidemic of obesity and diabetes: Trend and treatment”. Tex Heart Inst J 38(2011): 142-144.
3. Dhandhukya N. “Contribution of pathogene in human obesity”. Drug News Perspect 7(2000): 307-313.
4. Berg C, Roseneng A, Aires N, Lappas G, Torén K, et al. “Trends in overweight and obesity from 1985 to 2002 in Goteborg, west Sweden”. Int J Obes (Lond) 29(2005): 916-924.
5. Skliris EA, Mercouries P, Sotiriopoulos A, Xipolitou C, Liva H, et al. “The relationship between body mass index and hypertension in elderly Greeks, the Nemea Primary Care Study”. J Am Geriatr Soc 56(2008): 954-955.
6. Bhuyan KC and Fardus J. “Level of obesity and socioeconomic factors of a group of adult people of Bangladesh: A factor analysis approach”. Amer Jour Data Mining and KnowldgDiscov, 4(2019): 8-14.
7. Haslam DW and James WP. “Obesity”. Lancet 366(2005): 1197-1209.
8. John EH, Jussara M do, Carmo JM do, Silva AA da, Zhen W et al. “Obesity-Induced hypertension: Interaction of neurohumoral and renal mechanisms”. Circ Res 116(2015): 991-1006.
9. Theodore AK. “Obesity-related hypertension: Epidemiology, Pathophysiology, and clinical management”. Amer Jour Hypertension 23(2010): 1170-1178.
10. WHO. “Obesity and overweight”. Newsroom (2020).
11. Mahler RJ. “Diabetes and hypertension”. HormMetab Res 22(1990): 599-607.
12. Hall JE, Carmo JM do, Silva AA da, Wang Z, Hall ME. “Obesity-Induced Hypertension: Interaction of Neurohumoral and Renal Mechanisms”. Circ Res 116(2015): 991-1006.
13. Nielson C and Lange T. “Blood glucose and heart failure in non-diabetic patients”. Diabetic Care 28(2005): 607-611.
14. Branca F Nikogosian H, Lobstein TC, Copenhagen. “The Challenge of obesity in the WHO European region and strategies for response”. Public Health Panorama WHO (2007): 1-304.
15. Weiss R, Deria J, Burgert TS, Tamborlane WV, Taksali SE, et al. “Obesity and the metabolic syndrome in children and adolescents”. N Engl J Med 350(2014): 2362-2374.
16. Dinsa GD, Goryakin Y, Fumagalli E and Suhreke M. “Obesity and socioeconomic status in developing countries: A systematic review, Obesity Reviews”. Obesity reviews. 13(2012): 1067-1079.
17. Misra A and Khurana L. “Obesity and the metabolic syndrome in developing countries”. J Clin Endocrinol Metab 93(2008): 51-58.
18. Mansion JE, Willett WC, Colditz GA, Hunter DJ, Hankinson SE, et al. “Body weight and mortality among women”. N Engl J Med 333(1995): 677-685.
19. Bhuyan KC. “Socioeconomic variables responsible for exclusively diabetes among Bangladeshi adults”. ActaScientific Nutritional Health 4(2020): 1-6.
20. Fardus J and Bhuyan KC. “Discriminating diabetic patients of some rural and urban areas of Bangladesh: A discriminant analysis approach”. Euromediterrane Bio Jour 11(2016): 134-140.
21. Monteiro CA, Moura EC, Connel WL and Popkin BM. “Socioeconomic status and obesity in adult populations of developing countries”. Bull WHO 82(2004): 940-946.
22. Biswas T, Garnett P, Sarah BL. “The prevalence of underweight, overweight, and obesity in Bangladesh: Data from a national survey”. PLoS One 12(2017): e0177395.
23. Bangladesh Bureau of Statistics. Statistical Year Book of Bangladesh (2017): 1-65.
24. Biswas T, Garnett P, Sarah BL. “The prevalence of underweight, overweight, and obesity in Bangladesh: Data from a national survey”. PLoS One 12(2017): e0177395.
25. WHO Expert Consultation. “Appropriate Body Mass Index for Asian Population and its Implications for Policy and Intervention Strategies”. Lancet 363(2004): 157-63.
26. Jan AS, Yan Li, Anita H, KEI A, Eamon D et al. “Blood pressure measurement anno 2016”. Amer Jour Hypertens 30(2017): 453-463.
27. Akter S, Rahaman MM, Sarah Krull Abe, Sultana S. “Prevalence of diabetes and their risk factors among Bangladesh adults: a nationwide survey”. Bull WHO 92(2014): 204-213 A.
28. Bertino G, Ardini AM, Ali FT, PM Boemini, D Cilio, et al. “Obesity and related diseases: an epidemiologic study in eastern Sicily”. Minerva Gastroenterol Diet 52(2006): 379-385.
29. Calamusa G, Amadio E, Costantino C, Pasquale MD, Gelsomino V et al. “Body mass index and factors associated with overweight and obesity: a cross-sectional study of adult subjects living in a small city of Western Sicily (Italy)”. Ital J Public Health 9(2012): c7539-1-c7539-8.
30. Prasad SB, Fahrrash F, Malaiany Y, Meredith IT, et al. “Obesity and the metabolic syndrome in patients with acute myocardial infarction”. Int J Cardiol 144(2009): 450-451.
31. Bhuyan KC. “Identification of socioeconomic variables responsible for diabetic heart diseases among Bangladesh adults”. ARC Jour Dia Endo 5(2019): 1-8.
32. Everett B and Zajacova A. “Gender difference in hypertension and hypertension awareness among young adults”. BiodemographySocBiol 61(2015): 1-17.
33. Syed MS, Debra N, Muhammad HR, Musa R, Gul N. “Assessing obesity and overweight in a high mountain Pakistani population”. Tropic Med Intern Health 9(2004): 526-532.
34. Bhuyan D and Bhuyan KC. “Discriminating Bangladesh adults by non-communicable diseases”. Rehabilitation Science 4(2019): 35-43.
35. Bhuyan KC, Mortuza A, and Fardus J. “Discriminating patients suffering from non-communicable diseases: A case study among Bangladesh adults”. Biomed J Sci & Tech Res 10(2018).
36. Md Mortuza A, Bhuyan KC, Fardus J. “A study on identification of socioeconomic variables associated with non-communicable diseases among Bangladesh adults”. Amer J Biomed Sci and Engineering 6(2020): 24-29.
37. Bhuyan KC. “Discriminating Bangladesh adults by simultaneous prevalence of obesity, diabetes”. SerEndocrinDiabMetab 2(2020): 19-26.
38. Bhuyan KC. “Factors responsible for elevated blood pressure among Bangladesh adults”. Arch Diab & Obes 29(2020): 250-257.