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A Study on the effects of age and blood cholesterol on blood pressure: A case study of Hyderabad District of Sindh Province

NAEEM AHMED QURESHI
RIAZ ALI BURIRO
MUHAMMAD HANIF LAKHO
WASIF ALI SOLANGI
Department of Statistics, Sindh Agriculture University
Tandojam, Pakistan
MANSOOR HYDER DEPAR
SAJJAD HUSSAIN TALPUR
Information Technology Centre, Sindh Agriculture University
Tandojam, Pakistan

Abstract:

It is well documented in the literature related to medical research that there are so many factors causing heart attack. These factors include smoking, high cholesterol, high blood pressure, overweight, lack of exercise, alcohol age and sex family history, air pollution, drug misuse, lack of oxygen in blood, and aneurysm. One exceptional method of reducing the blood pressure of man is dependent on some factors that influence the level of blood pressure reading in the body such factors are age and blood cholesterol. These two variables were taken in the present research to study their effects on blood pressure. The primary data were collected from 200 respondents at Liaquat University Hospital (Civil Hospital), Hyderabad District and analyzed by using SPSS. This indicates that the systolic blood pressure levels were considerably higher in the respondents above the age of 57 years, followed by the age group of 48-57 years. The weak correlation was observed between age and blood cholesterol which indicates that it is not necessary that the blood cholesterol of a person

increases as the age increases. Increase in blood cholesterol is due to eating habits such as use of saturated fats in the diet. The strong correlation was observed between the blood cholesterol and blood pressure which is an indication that as the blood cholesterol of a person increases the risk of high blood pressure also increases. All the independent variables were individually highly significant. The coefficient of multiple correlation reveals that there is a strong positive relationship between the dependent and the independent variables. The goodness-of-fit of the model was assessed through coefficient of determination (R^2) which was reported as 0.75 which indicates that 75% of the variation in the dependent variable (blood pressure) is explained by the fitted regression model which is good enough to conclude that the model performs well.

Key words: effects of age and blood cholesterol, blood pressure, Hyderabad District, Sindh Province

1. INTRODUCTION

Age is considered medically as one of the major factors that affect the blood pressure of an adult. Age being the number of years of existence from birth to the present time is not determined by any factor, it is a compulsory biological change that cannot be controlled. Age comes along with growth, development and death (Ogunsakin et al. 2012).

Aging refers to the normal yet irreversible biological changes that occur throughout a person's life time. It is a very complex phenomenon and is influenced by genetic, environmental and life style factors (Tuomi *et al*., 1997). A mid middle age there is commonly an increase in muscle to fat ratios, and in a few people, centralization of muscle to fat quotients with its chaperon wellbeing danger might likewise happen. In exceptionally age, both fat free and fat mass are lost as body weight decays. The significance of the issue turn out to be all the more vital when the age related changes of physical

instruction experts are the center of the consideration as the vast majority of these experts have more open door for physical action.

Age, blood cholesterol and blood pressure are biological occurrence which are associated to man and other animals. This process is very important as it determines the state of well being and health level of a man. Blood pressure is the measurement of how much force the blood exerts on the wall of blood vessels. There are many events occur within the body as the heart pumps bloods, known as the cardiac cycle, and so pumps blood is measure at different point throughout this cycle. Systolic blood pressure measure the maximum pressure in the arteries during the cardiac cycle, which occurs when the heart contract or beat to pump blood. Blood pressure is affected by medication, cardiovascular or urological disorders, neurological conditions and psychological factors such as stress or anger. A healthy adult will have a blood pressure between 8o and 120 mmHg. Some of the ways to lower the blood pressure reading is by increasing physical activities, curbing alcohol consumption and increasing food content in the diet. Blood cholesterol is a fatty substance that occurs naturally in the body and which is necessary for hormone production, cell metabolism and other vital process. Having high cholesterol level in the blood can increase the risk of heart diseases and stroke. Blood cholesterol is also a factor that affects blood pressure. High blood cholesterol does not automatically lead to high blood pressure but many of the activities and the same life habits that may increase blood cholesterol may also cause elevated blood pressure. Example include diet high in saturated fat, lack of physical activities, taking too much of alcohol amongst others. The more years you spend as an adult the less active your body system becomes and this is where age is got something to do with blood cholesterol related to the blood pressure.

The relationship among age, blood cholesterol and blood pressure is a key to know the health status of human body and provide assessment for a number of health problems mostly causing heart attack. Thomas *et al.* (2002) reported in their study that the patients aged between 55 years are suffering from high blood pressure which dramatically increased cardiovascular disease and coronary heart disease risk. Likewise, Silawat *et al.* (2009) studied the impact of age on the blood cholesterol between different years of age. Statistically significant differences were witnessed in the blood cholesterol profiles between the age groups. Masaru *et al.* (2012) reported a direct relationship of dietary cholesterol to blood pressure of men in a few observational studies from the United States.

Therefore, knowing the significance status in human with respect to above biological variables the present study has been planned to know the relationship between age, blood cholesterol and blood pressure and at the same time study the effects of age and blood cholesterol on blood pressure of a human body.

2. MATERIALS AND METHODS

The primary data for the present study were collected from the Cardiology Department of Liaquat University Hospital, Hyderabad (also known as Civil Hospital, Hyderabad). Before the collection of data, a well defined questionnaire was developed. Besides several demographic characteristics, questions regarding age, blood cholesterol level, and blood pressure of respondents were also included in the questionnaire.

The sample size chosen for the present study was 200 respondents who were admitted in the hospital as heart patients. Statistical Package for Social Sciences, in short SPSS, is used for the analysis purpose.

2.1 Correlation Coefficient

Correlation is a statistical measure that indicates the extent to which two variables fluctuate together. A positive correlation indicates the extent to which those variables increase or decrease in parallel; a negative correlation indicates the extent to which one variable increases as the other decreases. Mathematically correlation coefficient can be calculated as follows:

$$r = \frac{n\sum XY - \left(\sum X\right)\left(\sum Y\right)}{\sqrt{\left(n\sum X^2 - \left(\sum X\right)^2\right)\left(n\sum Y^2 - \left(\sum Y\right)^2\right)}}$$

Where n stands for the total number of observations and X and Y are the two variables under consideration.

2.2 Multiple Linear Regressions

It investigates the dependence of one variable on more than one independent variables and provides the functional relation that is used for the estimating or predicting the value of the dependent variable from the known values of the independent variable(s). The dependent variable is assumed to be a random variable whereas the independent variables are assumed to have fixed values. The model can be expressed mathematically as under:

$$Y_i = \beta_0 + \beta_{1,i}X_{1,i} + \beta_{2,i}X_{2,i} + \ldots\ldots + \beta_k X_{k,i} + \varepsilon_i \qquad (i = 1,2,\ldots,n)$$

Where β_0 is the intercept of the regression equation and β_1, β_2 ,….., β_k are referred to as partial regression coefficients. In general, β_i represents the change in the *ith* variable when all the other variables in the system are being fixed as constant. The standard error and t-statistic for the estimated parameters are defined by the following equations:

$$S.E(\beta_i) = \sqrt{Var(\beta_i)}$$

$$t - statistic = {(\beta_i)}/{S.E(\beta_i)}$$

2.3 Analysis of Variance (ANOVA)

The analysis of variance (ANOVA) is a technique that partitions the total variation into its components parts, each of which is associated with a different source of variations such as "variation" among and between groups. The analysis of variance, therefore, compares two different estimates of variance by using F- distribution to determine whether the means are equal.

2.4 *Goodness-of-fit* of the Regression Model

Goodness-of-fit of linear regression model tells us how well a model fits the data set. One among the different ways to assess the goodness-of-fit of the regression model is through the coefficient of determination. The coefficient of determination is represented by R^2. The computation formula for R^2 is given as under:

$$R^2 = \frac{(\text{Sum of Square of Error})}{(\text{Sum of Squares of Total})} = \frac{SSR}{SST}$$

The value of R^2 lies between 0 and 1 (inclusive). For almost all model, the value of R^2 lies between these two extremes.

3. RESULTS AND DISCUSSION

3.1 Descriptive Statistics of Data set

Table 1 shows the summary statistics of the data under study. Minimum and maximum ages of the respondents were 18 and 65 yrs respectively. The mean age of the respondents was found to be 40.43 yrs with the standard error of 0.859. Likewise,

variations in blood cholesterol levels of the respondents were reported between 100 to 290 mm/dl with the mean value of 189 mm/dl which is higher than the normal cholesterol values of human being which are shown in Figure 1.

Table 1: Summary Statistics of the variables used in the present study

Variable	Minimum	Maximum	Mean	Std. Error
Age	18.00	65.00	40.43	0.859
Blood Cholesterol	100.00	290.00	189.00	2.693
Blood Pressure	98.00	190.00	136.00	1.340

Figure 1. The normal values of blood cholesterol in a human body

When the blood pressure of the respondents was measured, it was found in the minimum range of 98 mmHg and maximum of 190 mmHg with mean ± S.E (136 ± 1.340 mmHg).

3.2 Relationship between different age groups and the blood pressure

Table 2 shows the frequency distribution of the respondents with respect to different age groups and the values of their blood pressure. It can be seen from the results presented in the table below that the least number of respondents (14) were reported for the higher age group i.e., 57 yrs and above while the highest number (53) is reported for the second oldest age group i.e., 48-57 yrs. On the basis of the mean values, it can be seen that as the age of respondents increases the blood pressure levels also increases.

Table 2. Summary statistics of the different age groups' respondents and their blood pressure

Age (in yrs)	Blood pressure				
	N	Min.	Max.	Mean	Std. Error
18-27	33	98.00	145.00	118.42	2.62
28-37	52	110.00	165.00	132.52	2.18
38-47	48	100.00	165.00	135.77	2.24
48-57	53	120.00	190.00	145.30	2.21
Above 57	14	140.00	180.00	161.00	3.45

The normal values of systolic blood pressure in a human body are given as under:

*Normal 90 to 120 * low blood pressure less than 90

*Pre high blood pressure 120 to 140 *High blood pressure greater than 140

3.3 Correlation Analysis

Table 3 shows the correlation between the different variables used in the present study. It can be seen that all the variables study are positively correlated. The weak correlation was observed between age and blood cholesterol which indicates that it is not necessary that the blood cholesterol of a person increases as the person gets older. Increased blood cholesterol might be dependent on the eating habits (e.g., the use of saturated fats in the diet) of a person but not the age.

Table 3: Correlation Matrix of the Age, Blood Cholesterol and Blood Pressure

	Age	Blood Cholesterol	Blood Pressure
Age	1.000	0.219	0.570
Blood Cholesterol	0.219	1.000	0.759
Blood Pressure	0.570	0.759	1.000

Similarly blood pressure is moderately correlated with age having the value of 0.570 which is already reported in Table 2. Likewise, strong value of correlation coefficient (r = 0.759) was observed between the blood cholesterol and blood pressure

which is an indication that as the blood cholesterol of a person increases the risk of high blood pressure also increases.

3.4 Multiple Regression Analysis

Table 4 shows results of the multiple linear regression analysis which was carried out to study the effects of age and blood cholesterol on blood pressure. As already explained that regression is used to study the effect of independent variable(s) on the dependent variable i.e. the amount by which the dependent variable changes for the every unit change in the independent variable while the rest of independent variables remain constant. When age increases by one unit while all the other independent variables remain constant, the blood pressure will increase by 0.662. In the same fashion, if the blood cholesterol increases by one unit while the age remains constant, the blood pressure will increase by 0.331. P-values of the t-statistic show that all the variables on the right side of the regression equation are highly significant at conventional level of significance ($\alpha = 0.05$).

Table 4: Estimates of the Multiple Linear Regression model

Variables	β_i	$S.E(\beta_i)$	$t-stat$	$p-value$
Constant	46.955	3.778	12.43	0.000
Age (X_1)	0.662	0.057	11.55	0.000
Blood Cholesterol (X_2)	0.331	0.182	18.13	0.000

3.5 Analysis of Variance (ANOVA)

The F-value in the following table tests whether the overall regression models is a good fit for the data set under consideration. The table shows that the independent variables statistically significantly predict the dependent variable because the calculated F-value is much larger than the α-quantile of the F-distribution and P-value of the F-test if much lower than 0.05.

Table 5: Analysis of Variance (ANOVA) Table

Source of Variation	d.f	SS	MS	F-value	Sig.
Regression	2	53381.50	26690.74	290.60	0.000
Residuals	197	18093.88	91.85		
Total	199	71475.35	-----	-----	-----

3.6 R, R^2, Adjusted-R^2 and Std. Error of the Fitted Model

The coefficient of multiple correlation (R = 0.864) reveals that there is positive relationship between the dependent and independent variables. The value of coefficient of determination (R^2 = 0.75) indicates that 75% of the variations in the dependent variable (blood pressure) is explained by the fitted regression model which is good enough to conclude that the model performs well in terms of prediction.

Table 6: R, R^2, adjusted-R^2 and Std. Error of the Estimated Model

R	R Square	Adjusted R Square	Std. Error of the Estimate
.864	.75	.744	9.583

Similarly, the value of adjusted-R^2 (0.744) shows with the present adjustment of the parameters in the regression model the model accounts nearly for same variation in the data set as without adjusting parameters.

4. CONCLUSIONS AND SUGGESTIONS

Based on the findings of the present study, it can be concluded that there is a weak relation between age and blood pressure while strong relation between blood cholesterol and blood pressure of a human body. The relationship between the blood pressure, blood cholesterol and age using least square regression method has been tackled to a reasonable extent. Similarly, blood cholesterol of a human body is not mainly affected by the age but due to the eating habits because people

who use more fats in their diet are likely to have high blood cholesterol levels. Likewise, blood pressure is less dependent on age while more dependent on blood cholesterol level of a person. It is well understood from this study that the level of blood pressure reading in the body can be influenced by age and blood cholesterol; therefore it is advisable for every individual above the age of 18 years to be going for medical check- up at least once in 3 months. Due to this, if any changes are found in their body system, these can easily be traced and managed. Government at every level should sensitize their subjects on the need to reduce any food that can increase the level of blood cholesterol in the body viz a fatty food.

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