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Risk Factors and Diabetes Mellitus (Statistical Study of Adults in Lahore, Pakistan)

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Abstract

The effect of different risk factors on diabetes was estimated in a cross-sectional hospital based study both with descriptive and analytic components. Sample of 580 persons aged 20 years and above (153 men, 427 women) entering the diabetic center as outdoor persons during the months March 2002 – August 2002 was taken. Urine and blood glucose test were performed and the diagnoses of diabetes was made according to W.H.O. criteria. Heights, weights, BMI and blood pressure of the study population were recorded. The chi–square test was used to measure the association among the different variables and logistic regression technique was applied to check the main significant risk factors and for the prediction of model. The researcher by using a standard questionnaire, collected information's regarding the risk factors from the subjects. In complete sample analysis, the factors obesity (O.R=2.204, P=0.000), Exercise (O.R= 0.173, P=0.000) and hypertension (O.R=1.056, P=0.004) were significant. But exercise was negatively associated while hypertension and obesity were positively associated with DM. In males only family history of diabetes is the main significant risk factor, which was positively associated with DM, and in females exercise, obesity and hypertension were the significant risk factors where as obesity and hypertension in females were positively associated while exercise as in the complete sample analysis was negatively associated. The study highlighted the results that DM is not due to any single risk

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factor but this disease may cause due to more than one risk factors. As in this study and other studies in Pakistan it is observed that obesity is the main cause of diabetes.

Key Words: Diabetes, Obesity, Risk Factor

1. Introduction

The problem under consideration is to estimate the effects of different risk factors on diabetes and draw out a main factor that is responsible for this disease. Earlier a lot of work has been done on diet, medication and after effects of this disease but it is the need of an hour to know about the cause of this disease. Diabetes mellitus (DM) is now a leading cause of morbidity and mortality through out the world. It can be diagnosed by blood and urine tests. It is diagnosed if random blood sugar level is more than 200mg/100ml of blood and fasting blood sugar is more than 140mg/100ml. Pakistan is currently 8^{th} in the world ranking of diabetes and will become 4^{th} by the year 2025.

In Pakistan, to the best of the researcher's knowledge there are no published studies which covers all the risk factors included in this research about the risk factors of diabetes. Earlier most of the work in the medical science about diabetes is just to estimate the proportion of risk factors i.e. descriptive studies but in this research results are presented in descriptive as well as analytic study. Earlier there is no concept of model building about risk factors of diabetes; therefore in this study a model is build, which predict the strength of significant risk factor of diabetes mellitus.

The aim of this research was to study the significance of certain risk factors on the development of significance diabetes in Sir Ganga Ram hospital, Lahore and to assess the predictive strength of known clinical risk factors with diabetes. The specific objective were, to develop a clinical prediction model by using observed predictive strength of these risk factors, to assess the association of each individual risk factor with diabetes and fitting an appropriate model for risk factors of diabetes. This study also tells us about the most significant risk factor of diabetes for male and female persons.

Matsuda et al (1984) analyzed the family history of diabetes in parents and siblings in relation to the age of onset and previous

obesity in-persons with non-insulin-dependent diabetes mellitus (NIDDM) whereas Morris, R.D. et al (1989) examined the obesity and family history of NIDDM in a cross-sectional study. Naliboff et al (1989) studied the effects of age on complication in adult onset diabetes and Hagura (1994) analyzed that the frequency of a positive family history of diabetes in diabetic persons has increased in recent studies. Chou (1994) studied risk factors of non-insulin-dependent diabetes. Gender, age, education level, family history, obesity, hypertension, triglyceride, cholesterol level were the risk factors in this study. Qadeer (1997) interviewed the diabetic and non-diabetic persons for history of diabetes mellitus among their first-degree relatives. The protocol also included second and third degree relatives. Shere et al (1998) conducted Pakistan national diabetes survey on prevalence of glucose intolerance and its associated risk factors in four provinces. Shmulewitz (2001) studied the cause of morbidity and mortality.

2. Methodology

This is a cross-sectional study consisting descriptive and analytic components. It is hospital-based study and cross sectional sample of 580 persons both males and females admitted to diabetic ward as outdoors persons was taken. The sample was taken on time basis and persons admitted were included in samples considering that these persons belong to super population. Study was conducted at Sir Ganga Ram Hospital; Lahore during the period march-August 2002 and this hospital fulfils the requirements of treatment of Lahore City. Data was collected from the males and females by the Questionnaire designed by the researcher after consultation with the medical advisor. The medical officers provided the forms and collected after the completion of the form.

Questionnaire was consist of bio-data of the person as well as seven risk factors including age of the person, Gender, Obesity, Exercise, Family history of diabetes, income and hypertension. The person was considered to be diabetic if urinary glucose is present and blood sugar fasting is >141 mg/ml or blood sugar random or 2hrs past paradial is >200 mg/ml

The duration of this study was six months and it was conducted in four phases' i.e. preparatory phase, pilot study, data

collection phase and date analyzing and reporting. The data was processed and entered daily by the researcher using SPSS version 10.0 for windows in to an IBM personal computer. All the variables were pre-coded by the researcher for computer analysis. Researcher performed data analysis using SPSS version 10.0 for windows.

2.1 Description of Variables under study

- **Age:** Persons of all ages over 20 years onwards are included in this study. Age will be counted to nearest year. In main analysis age is used as continuous variable but in order to explore the problem it has been categorized in two groups.
- **Gender:** All males and females of persons entering the hospital in the prescribed period:
- **Obesity:** To check the obesity, Body Mass Index (BMI) was calculated by

  Body mass index = weight in kg / (height in meter2)

  20-25 Normal
  25-30 Over weight
  > 30 Obesity

- **Life style and exercise**

  A: <u>Sedentary</u>

  Sedentary life style involved official work and not much walking around during normal work. Similarly sedentary life-style also consists of no work and no walk.

  B: <u>Light</u>

  In the light exercise during of time is between 15-30 minutes in a day.

  C: <u>Moderate/Severe</u>

  Individuals involved in a minimum of 45 minutes of jogging or brisk walks for at least 4 days of week or individuals involved in strenuous employment or involved in strenuous household work (gardening, mopping, frequent climbing of stairs etc)

- **Hereditary:** It is suspected that blood relatives of people with diabetes are more likely to develop diabetes than those who do not have it in their family. The risk depends upon the number of family members who have diabetes therefore hereditary is also taken as independent variable in this study.

- **Income group / Psycho-social factors:** It was believed that due to low income diabetes can occur so this risk factor was also included in this study

  After consulting with economists, in this study three classes are taken.

Class	Monthly income
Lower class	< 3000 RS
Middle class	3000-10,000
Upper class	> 10,000

- **Hypertension:** In this study both the type of blood pressure is taken.

  (a) Systolic blood pressure in sitting. Systolic blood pressure in standing.

1- Normal	100-160
2- Hypertension	>160
3- Postural Hyper	>200

  (b) Diastolic blood pressure in sitting. Diastolic blood pressure in standing

1- Normal	70-90
2- Hypertension	>90
3- Postural Hyper	>100

  The person is considering as hypertensive if any one or both the blood pressure are not normal. And the person is considered as non –hypertensive if any one or both the blood pressures are normal.

2.2 Diagnostic Criteria

The diagnostic criteria for diagnosis of DM recommended by the W.H.O Study Group (1985) were used to classify glucose tolerance status. The diagnostic values used were:

For DM: fasting venous plasma glucose > 140mg/dl or 2 h venous plasma glucose > 200mg/dl.

Diabetes was considered to be already present if a physician had made the diagnosis of diabetes previously.

The Odds Ratio: Measure of association for 2×2 contingency tables called the odds ratio. This is a fundamental parameter for the logistic regression models. In 2×2 tables, if the probability of "success" is π1 in row 1 and π2 in row2. Within row 1, the odds of success are defined to be

$Odds_1 = \pi_1 / (1 - \pi_1)$

Within row 2, the odds of success equal

$$Odds_2 = \pi_2 / (1 - \pi_2)$$

In either row, the success probability is the function of the odds,

$$\pi = odds / (odds + 1)$$

The ratio of odds from the two rows,

$$\theta = odds1/odds2 = \pi 1 / (1 - \pi 1) / \pi 2 / (1 - \pi 2)$$

is called the odds ratio.

Logistic Regression:

The quantity π (x) = E (*Y*|x) is used to represent the conditional mean of Y given x when the logistic distribution is used. The specific form of the logistic regression model use is as follows:

$$\pi(x) = \frac{e^{\beta_o + \beta_1 x}}{1 + e^{\beta_o + \beta_1 x}}$$

A transformation of π (x) that will be central to our study of logistic regression is the logit transformation. This transformation is defined, in terms of π (x), as follows:

$$g(x) = \ln\left[\frac{\pi(x)}{1 - \pi(x)}\right]$$

$$= \beta_o + \beta_1 x$$

For binary response y and a quantitative explanatory variable x, let π (x) denote the "success" probability when x takes value x. this probability is the parameter for the binomial distribution. The logistic regression model has linear form for the logit of this probability.

$$\log it[\pi(x)] = \log\left(\frac{\pi(x)}{1-\pi(x)}\right)$$
$$= \alpha + \beta x$$

An alternative formula for logistic regression refers directly to the success probability. This formula uses the exponential function $\exp(x) = e^x$ in the form

$$\pi(x) = \frac{\exp(\alpha + \beta x)}{1 + \exp(\alpha + \beta x)}$$

We assume that x is coded as either 0 or 1. Under this model there are two values of π (x) and equivalently two values for 1-π (x). These values may be conveniently displayed in a 2×2 table as shown in table given below:

y=1	$\pi(1) = \frac{e^{\beta_0+\beta_1}}{1+e^{\beta_0+\beta_1}}$	$\pi(0) = \frac{e^{\beta_0}}{1+e^{\beta_{01}}}$
y=0	$1-\pi(1) = \frac{1}{1+e^{\beta_0+\beta_1}}$	$1-\pi(0) = \frac{1}{1+e^{\beta_{01}}}$
Total	**1.**	**1.0**

The odds of the outcome being present among individuals with x = 1 is defined as π (1)/[1-π (1)] similarly, the odds of the outcome being present among individuals with x = 0 is defined as π (0)/[1-π (0)] the log of the odds is called the logit and, in this example these are

g (1) = ln{π(1)/[1-π(1)]}

And g (0) = ln {π (0)/ [1-π(0)]}

The odds ratio denoted by ψ, is defined as the odds for x=1 to the odds for x = 0 and is given by the equation

$$\Psi = \frac{\pi(1)/1-\pi(1)}{\pi(0)/1-\pi(0)}$$

The log of the odds ratio, termed log –odd ratio, or log-odds, is

$$\ln(\Psi) = \ln\left[\frac{\pi(1)/(1-\pi(1)}{\pi(0)/(1-\pi(0)}\right]$$

$$\text{Ln}\ (\psi) = g(1)-g(0)$$

Which is the logit difference

Now using the expressions for the logistic regression model shown in the table the odds ratio is

$$\Psi = \frac{\left(\frac{e^{\beta_0+\beta}}{1+e^{\beta_0+\beta}}\right)\left(\frac{1}{1+e^{\beta_0}}\right)}{\left(\frac{e^{\beta_0}}{1+e^{\beta_0}}\right)\left(\frac{1}{1+e^{\beta_0+\beta}}\right)}$$

$$= \frac{e^{\beta_0+\beta}}{e^{\beta_0}} = e^{\beta_1}$$

Hence for logistic regression with the dichotomous independent variable

$$\Psi = e^{\beta_1}$$

And the logit difference or log odds is

$$\ln(\Psi) = \ln(e^{\beta_1}) = \beta_1$$

This fact concerning the interpretability of coefficients is the fundamental reason why logistic regression has proven such a powerful analytic tool for epidemiological research.

a100 (1-α) % CI for the coefficient are of the form

$$\hat{\beta}_{ij} \pm Z_{1-\alpha/2} * \hat{SE}(\hat{\beta}_{ij})$$

The corresponding limits for the odds ratio are obtained by exponentiating these limits as follows:

$$\exp\left[\hat{\beta}_{ij} \pm Z_{1-\alpha/2} * \hat{SE}(\hat{\beta}_{ij})\right]$$

2.3 Strategy for Analysis

Diabetes was taken as dependent variable and its categories were “YES” and “No”, “YES” means that person is diabetic and “NO” means that diabetes is absent. Seven variables including (i)

Age (2) Gender (3) Obesity (4) Income (5) Exercise (6) Family history of diabetes (7) Hypertension, were taken as independent variables. All independent variables were also coded before analysis, because independent variables were also in categories. Descriptive analysis, bivariate analysis and multivariate analysis were used. In multivariate analysis logistic regression technique was applied. Some tests were also applied for checking the adequacy of the model.

Coding Scheme of the Variables

No	Variable	Code Number
1	Age	Years
2	Age Code	0 If age < 40 and 1 If age ≥ 40
	Gender	0 For male and 1 for female
4	Obesity	0 = Non-Obsessed, 1 = Obsessed
5	Income	1 = High, 2 = Middle, 3 = Low
6	Family History	0 = Absent, 1 = Present
7	Lifestyle & Exercise	0 = Sedentary, 1 = Light, 2 = Moderate
8	Hypertension	0 = Non hypertension, 1 = hypertension
9	Diabetes	0 = Absent, 1 = Present

3- Results & Discussion

3.1 Descriptive Analysis

There were 580 subjects in the sample out of which 153 (26.38%) were males and 427 (73.62%) were females, in total sample 360, (62.07%) were diabetic and 220 (37.93%) were non-diabetic.

Descriptive analysis for all the risk factors of DM is given below:

- **Age**

The minimum age of Person recorded was 20 years and maximum age was 85 years. The average age of Person is 51 years.

In complete sample analysis, 51 (8.79%) persons were less than 40 years and 529 (91.21%) were greater than 40 years. Out of 360 diabetic persons, 34 (9.44%) were less than 40 years and 326

(90.55%) were greater than 40 years. From 51 persons who were less than 40 years, 17 were non-diseased and 34 have DM and from 529 persons who were greater than 40 years, 203 were non-diseased while 326 had positive DM.

- **Gender**

There were 153 males and 427 females persons in a sample of 580

Percentage of male persons = 26.38%

Percentage of female persons = 73.62%

Among 360 persons with positive DM, 93 (25.83%) were male and 267 (74.17%) were females. Among 153 male persons, 60 (39.22%) were non-diseased and among 427 females, 160 (37.47%) were non-diseased.

- **Obesity**

The number (percentage) of persons obese and non-obese was 162 (27.93%) and 418 (72.07%) respectively. Among 360 persons with diabetic disease, 281 (78.06%) were non-obese and 79 (21.94%) were obese. Among 162 obese persons, 83 (51.23%) were non-diseased and remaining 79 (48.77%) were with positive DM.

- **Income Group**

The number (percentage) of persons in high, middle and low-income group was 90 (15.52%), 234 (40.34%) and 256 (44.14%) respectively. Among 360 persons with positive DM, 54(15%) were from high-income group, 141(39.17%) were middle-income group and 165 (45.83%) were from low-income group.

- **Family History**

The number (percentage) of persons with and without significant finally history of diabetes disease were, 392 (67.59%) and 188 (32.41) respectively. Among 360 persons with positive DM, 118 (32.77%) were without family history of diabetes disease while remaining 242 (67.23%) were with family history of DM.

Among 392 persons with significant family history of DM, 150 (38.27) were non-diseased while 242 (61.73) were with positive DM.

- **Life style and exercise**

The number (percentage) of persons in sedentary, light and moderate exercise group was 140 (24014%), 362 (62.41) and 78 (13.45%). Among 360 persons with positive DM, 52 (14.44%)

were sedentary, 249 (69.17) were light and 59 (16.39) were in moderate group.

- **Hypertension**

The number (percentage) of Person's hypertensive and non-hypertensive were 224 (38.62%) and 356 (61.38%) respectively. Among 360 persons with positive DM, 154 (42.77%) were hypertensive and 206 (57.22%) were non-hypertensive while among 224 hypertensive persons, 70 (31.25%) were without disease and 154 (68.75%) were with disease of diabetes.

Table: 1

Frequency Table for Descriptive Analysis

Variable		Frequency
Income	1	90
	2	234
	3	256
Exercise	0	140
	1	362
	2	78
Sex	0	153
	1	427
Obesity	0	418
	1	162
Hypertension	0	356
	1	224
Family history	0	188
	1	392
Age	0	51
	1	529

Table: 2 Classification Table for over all DM

Variable		0	1	Total
Age Code	0	17	34	51
	1	203	326	529
Obesity	0	137	281	418
	1	83	79	162
Income group	1	36	54	90
	2	93	141	234
	3	91	165	256
Family History	0	70	118	188
	1	150	242	392
Lifestyle & Exercise	0	88	52	140
	1	113	249	362
	2	19	59	78
Hypertension	0	34	206	356
	1	70	154	224

- **Analytic Section**

  Analytic section consists of two categories

  (i) Bivariate Analysis

  (ii) Multivariate Analysis

3.2 Bivariate Analysis

In this section the association of every risk factor was tested with DM, and Phi/Cramer's V value were computed for the variables which were significant in order to find the strength of association of these resultant significant risk factors with DM. For this purpose χ^2test was applied.

The results of chi-squared are shown in

Table: 3 **Chi-squared table for complete sample analysis**

Variable	χ^2	d.f	P-Value	Result	Phi or Creamer's V Value
Age Code	0.502	1	0.479	N.S	0.029
Sex	0.146	1	0.703	N.S	0.016
Obesity	16.898	1	0.000	S	0.171
Income Group	1.108	2	0.575	N.S	0.044
Family History	0.057	1	0.811	N.S	0.010
Exercise	49.983	2	0.000	S	0.294
Hypertension	6.919	1	0.009	S	0.109

It was found that the risk factors; obesity, life-style and hypertension were significantly associated with DM. Exercise has the largest phi/creamer's V value (0.294). So it was highly associated with DM among all the significant risk factors.

3.3- The Multiple Logistic Regression Model

The main object of this study was to determine the predictive strength of DM. For this multiple logistic regression model technique was applied. Later on the Wald test and score test werte used to assess the significance of the regression Co-efficients.

In multiple logistic regression model backward elimination method option was used.

As shown in table 4, four risk factors; gender, obesity, exercise and hypertension are significant because for the variables obesity, exercise and hypertension; p-value is less then 0.05, only one variable gender has the largest value than 0.05 but this variable is insignificant in the χ^2 test of association. Due to this reason we analyze the data separately for male and female persons. The reference group for the risk factor gender was taken as male persons.

Table: 4

LOGISTIC REGRESSION OUTPUT

Variable	$\hat{\beta}$	S.E ($\hat{\beta}$)	Wald	d.f	P-Value	Odds Ratio
Gender (1)	-0.370	0.210	3.091	1	0.079	0.691
Obesity	0.790	0.200	15.601	1	0.000	2.204
Exercise (1)	-1.752	0.328	28.540	1	0.000	0.173
Exercise (2)	-0.364	0.294	1.538	1	0.215	0.695
Hypertension	0.560	0.192	8.476	1	0.004	1.056
Constant	1.062	0.336	10.005	1	0.002	2.892

The odd ratio of 0.691 for Gender (1) indicates that female persons have 1-0.691 = 0.308 (30.8%) protection against DM, keeping all other factor constant.

The reference group for obesity was taken as non-obese persons. The odd ratio for obesity is 2.204, which shows that an obese person has 2.204 times more chance of getting a significant DM as compared to non-obese persons keeping all other factors constant.

The reference group for, exercise is sedentary life style. The odd ratio for light exercise is 0.173 which shows that the person who do light exercise have 0.827 probability of protection against diabetes. While the odd ratio for severe exercise is 0.695, which is also less than 1, so the probability of protection against diabetes for this category is 0.305.

The reference group for hypertension was taken as non-hypertension persons. The odd ratio for hypertension is 1.056, which means that a hypertensive Person has 1.056 times more chance of getting a significant DM as compared to non-hypertension persons keeping all other factors constant.

The odd ratio of constant gives the odd ratio of background and baseline. And odd ratio for the constant is 2.892. It means a person with presence of significant variables have 2.892 times more chance of suffering from DM as compared to a person in which these variables are at reference level.

3.4 - Goodness of Fit for the Model

Table: 5 **Goodness of fit for the Overall Logistic Regression Model**

Observed DM	Predicted DM		
	0	1	
0	81	139	36.8%
1	43	317	88.1%
			68.6%

From the table 5, it was observed that out of 220 persons with non-significant DM, 81(36.8%) persons are correctly predicated by the model similarly out of 360 persons with significant DM, 317(88.1%) persons are correctly predicted by the model. From total of 580 persons, 398 (68.6%) are correctly predicted by the model.

While the off diagonal entries of the table tell us that how many respondents are misclassified. A total of 182 (31.74%) are misclassified, of which, 139 are with non-significant DM and 43 are with significant DM.

The value of model chi-square is 75.190 (P-value = 0.000) with d.f = 5. This is highly significant therefore we are 95% confidant that the fitted model is appropriate.

Confidence Limits for the Odds Ratio

Table: 6 95% Confidence limits for the odd ratio

Variable	$\hat{\beta}$	S.E ($\hat{\beta}$)	Odd ratio	95% Confidence Limits L.C.L	U.C.L
Sex	-0.370	0.210	0.691	0.4576	1.0424
Obesity	0.790	0.200	2.204	1.4888	3.260
Exercise (1)	-1.752	0.328	0.173	0.09	0.3298
Exercise (2)	-0.364	0.294	0.695	0.391	1.236
Hypertension	0.560	0.192	1.056	1.20	2.55
Constant	1.062	0.336	2.892	1.497	5.587

In this table 95% Confidence interval is calculated to the odds ratio for the significant risk factors.

As all the variables are coded as (0, 1) so the confidence limits are calculated simply by taking the exponents of the confidence limits for the regression co-efficient.

The odd ratio for the variable gender is less than 1 and the 95% confidence interval for sex includes 1 therefore odd ratio for gender is not significantly different form reference group.

The odd ratio for obesity is greater than 1 and the 95% confidence interval for obesity does not include 1 therefore obesity has a positive association with DM and is statistically significant.

As odd ratio for the life-style and exercise (active) is less than 1 and 95% confidence interval for exercise (active) does not include 1 therefore odd ratio for exercise (active) is significantly different from reference group.

Similarly odd ratio for the life-style & exercise for severe is less than 2 and 95% confidence interval for exercise (severe) does not include 1 therefore exercise (severe) is significantly different from reference group sedentary.

As the odd ratio for hypertension is greater than 1 and 95% confidence interval for hypertension does not include 1 therefore hypertension is significantly different from reference group and is positively associated with DM.

Logit Model for Complete Sample Analysis

=1.06-. 370*Sex (1) + 0.790 * Obesity – 1.752 * Exercise (light) – 0.364 * Exercise (severe) +0.560*Hypertension

4. Summary & Conclusions

4.1 Summary

With the consultation of doctors the research problem "Risk factors and diabetes mellitus" was selected. The aim of this research was to study the significance of certain risk factors on the development of significance diabetes and the Specific objectives of this study was to assess the predictive strength of known Clinical risk factors with diabetes. Specific objective of the study was to develop a Clinical prediction model to discriminate between with and with out significant Diabetes disease. The present study also tells us about the most significant risk factor of DM for male and female persons.

After selecting the topic, introduction and literature review of problem was collected from different sources i.e. books magazines, Internet, and pamphlets on Problem, different national and international journals and research papers regarding diabetes.

A questionnaire was developed with senior doctors of Sir Ganga Ram Hospital Lahore comprising the bio-data of persons and following risk factors of diabetic disease.

(1) Age (2) Gender (3) Obesity (4) Income (5) Family History (6) Exercise and (7) Hypertension

A pre test on first 25 persons was tested so

(i) To check the validity of questionnaire
(ii) To delete the unnecessary questions and addition of new questions.
(iii) To measure time required to complete questionnaire

A cross-sectional and convenience sample of 580 persons consisting of both males and females without any discrimination of

researcher's choice was taken who enter the diabetic ward as outdoor persons during the period March 2002 – August 2002.

The data was collected by the researcher's himself and with the assistance of trained enumerator by interviewing and filling the prescribed questionnaire. The person's blood and urine test was made according to W.H.O study group (1985)

For DM: fasting venous plasma glucose> 140 Mg/dl or 2h venous plasma glucose > 200 mg/dl.

After collecting the data, the data was coded according to pre-coded criteria for statistical Analysis as (i) Age lf<40then 0 lf>= 40 then I (ii) 0 for male I for female (iii) 0 for non-obese I for obese (iv) I for high income, 2 for middle and 3 for low income group (v) 0 for sedentary life style, I for light and 2 for severe exercise (iv) 0 if F/h absent and I for present (vii) 0 for Non-Hypertension and I for Hypertension.

The coded data was then entered in to and IBM compatible personal computer. The analysis was made on the basis of descriptive and analytic bases by using software S.P.S.S version 10.0 (statistical package for social sciences). In descriptive analysis, frequency distribution, percentages, means of variable age and cross tabs to check the association between different attributes of the data was calculated and in bivariate analysis, chi-square test was applied to check the significance of different variables by comparing this statistic with P-value. Further statistical aspects of, DM were tested by using multiple logistic regression analysis.

The multiple logistic regression technique was used for analysis because of

(i) Dependent variable or outcome variable was categorical in nature i.e. diabetes is present or absent.

(ii) Most of independent variables or covariates were also categorical. Age was taken as continuous as well as categorical by grouping the age in to two groups.

In overall analysis, obesity (O.R=2.204,P=0.000, 95%C.l =1.4888-3.260) and hypertension (O.R=1.056,P=0.215,95%C-I=1.20-2.55) are positively associated with DM, while exercise is negatively associated with D.M. In male persons analysis F/H is only highly significant factor and is positively associated (chi-square =3.311,P=0.069) and for multivariate analysis

(O.R=1.988,P=0.071) with 95% C.I (0.92-4.1944) and in females, obesity (O.R=2.569,P=0.000) and hypertension (O.R=0.113,P=0.000) are significant risk factor for diabetes mellitus and are positively associated with DM while exercise is negatively associated.

After obtaining the results from computer the results were discussed for further manipulation.

4.2 Conclusions

The results of this cross –sectional hospital based study provide information regarding the significant risk factors of DM in Lahore- Pakistan.

It is observed that females (427) are greater than males (153). The reason for large number of women than men may be the population (Hospital) from which the data is collected is related to a female medical college therefore ratio of women Person is greater than men.

(1) In the overall analysis the risk factors gender (females), obesity, exercise and hypertension are significant. Obesity and hypertension are positively associated with DM whereas; exercise is negatively associated with DM.
(2) In the male Person's analysis, family history of diabetes is only the main significant risk factor.
(3) In the females; obesity, exercise and hypertension are the main significant risk factors; like the overall analysis exercise is negatively associated but the remaining two factors i.e. obesity and hypertension are positively associated with DM. Since female gender was associated with higher BMI (p=0.000) and odd ratio for obesity in females is greater than all the significant risk factor, therefore in females, obesity is highly significant and may be the cause of diabetes disease.

Since in male persons analysis, family history of diabetes is the significant risk factor, which is positively associated, this result is according to the Western and other Asian studies of diabetes.

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