

# Associated Sociodemographic and Clinical factors with Hypertension and Dyslipidemia in Type 2 diabetes: A Hospital Based Cross-sectional Study

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**Abstract—** *Diabetes Mellitus (DM) is a chronic and progressive condition with a hereditary predisposition which is further induced by unhealthy lifestyle. It is a silent killer with cardiovascular complications being most common cause of morbidity and mortality in patients with T2DM.*

**Objective:** *To find out association of socio demographic and clinical parameters of diabetes type 2 with hypertension and dyslipidemia among Diabetes Mellitus type 2 cases aged 18 to 70 years.*

**Methodology:** *A cross sectional hospital based study was conducted on 272 type 2 DM patients attending Department of Medicine in a secondary care referral hospital after taking consent.*

**Results:** *Hypertension was present in 192 (70.59%) and dyslipidemia was present in 93 (34.19%) of type 2 diabetes patients. Age, family income, presence of family history, duration of illness, type of treatment, consumption of alcohol , BMI, Hba1c level were found to be associated significantly with both hypertension and dyslipidemia in type 2 DM patients.*

**Key Words:** *Diabetes Mellitus, Hypertension, Dyslipidemia , Body mass Index*

## I. INTRODUCTION

Diabetes Mellitus (DM) is a chronic and progressive condition with a hereditary predisposition which is further induced by unhealthy lifestyle. It occurs when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces due to insulin resistance. It is a silent disease that kills one person every 10 seconds. In 2014 the global prevalence of diabetes was estimated to be 9% among adults aged 18+ years.<sup>1</sup> In 2012, an estimated 1.5 million deaths were directly caused by diabetes. More than 80% of diabetes deaths occur in low- and middle-income countries.<sup>2</sup> WHO projects that diabetes will be the 7th leading cause of death in 2030.<sup>3</sup> India is undergoing a rapid economic development and urbanization which are having immense effect health problems in the community and leading to a shift in paradigm from communicable to non-communicable diseases like diabetes. Because of its high prevalence, India is infamously known as the Diabetes capital of the world.<sup>4</sup>

Cardiovascular complications are indeed the most common cause of morbidity and mortality in patients with T2DM.<sup>5</sup> Myocardial ischemia due to coronary atherosclerosis commonly occurs without symptoms in patients with diabetes. The recent increase in cardiovascular mortality and morbidity in diabetic patients offer the ample time to study risk factors for predicting the risk of CVD in these populations.

As the risk of development of diabetes varies between different ethnic populations, therefore, it is necessity of medical science to have population-based data to identify the risk factors for cardiovascular disease in diabetes so that Prevention strategies for health promotion can be planned and implemented to control and treat the diabetes and its complications according to local ethnicity. Hence the present study is designed to investigate the prevalence of hypertension and dyslipidemia in type 2 diabetes. This study also explores the association of socio demographic and clinical parameters of diabetes type 2 with hypertension and dyslipidemia.

## II. METHODOLOGY

This cross sectional study was conducted by Department of Medicine in a secondary care referral hospital. Diabetes patients are evaluated in detail in routine clinical practice and all relevant biochemical tests are performed. The nature and purpose of the study was explained to all the participants and informed consent was obtained prior to their inclusion in study sample.

Study sample comprised of 272 patients of diabetes between the ages of 18 to 70 years attending the outpatient department of diabetes clinic. A diagnosis of DM was confirmed using criteria established by the American Diabetes Association.<sup>6</sup> Level of blood sugar was found either from medical records or in the absence of medical records, confirmation was done on self-reported cases by establishing the criteria of regular treatment with anti-diabetics drugs. A detailed evaluation of socio demographic and clinical profile was made on specially designed semi structured performa by interviewing the participants and exploring the medical records including investigations.

Subject's Height was measured with the help of stadiometer (nearest to 0.1 cm) and weight with the help of standard weighing machine with minimal clothing (nearest to 0.01 kg). The body mass index was calculated with above two measurements. Body mass index (BMI) values were defined as per International Standards and a study subject was considered obese if the BMI  $\geq 30$  kg/m<sup>2</sup> and overweight if BMI = 25-30 kg/m<sup>2</sup> (16). Venous blood samples of blood were collected. Random plasma glucose levels lipid profile and HbA1c values were measured by appropriate laboratory methods. Blood pressure was taken by sphygmomanometer in sitting position. Blood pressure (BP) was recorded, after the subjects had rested for at least five minutes. Two readings were taken five minutes apart and the mean of two was recorded as the blood pressure.

National Cholesterol Education Programme (NCEP) guidelines<sup>7,8</sup> were used for diagnosis of dyslipidemia :a) Hypercholesterolemia: Serum cholesterol levels  $>200$  mg/dl or drug treatment for hypercholesterolemia, and/or b) High LDL cholesterol: LDLC  $>100$ mg/dl or drug treatment for high LDL cholesterol, and/or c) Hypertriglyceridemia: Serum triglyceride levels  $>150$  mg/dl or drug treatment for hypertriglyceridemia and/or d) Low HDL cholesterol: HDL cholesterol levels  $<40$  mg/dl for men and  $< 50$  mg/dl for women. Hypertension was diagnosed based on drug treatment for hypertension or if the blood pressure was  $>140/90$  mmHg according to Joint National Committee-7 (JNC-VII) criteria.<sup>9</sup>

### 2.1 Statistical Analysis

Data were summarized and analyzed in MS Excel 2007. These data were classified and analysed as per the aims and objectives. The data on sample characteristics was described in the form of tables. Categorical variables were tabulated using frequencies and percentages. Inferential statistics such as Chi square test was used to find out association of Hypertension and Dyslipidemia with various factors and

odds ratio was calculated between Hypertension and Dyslipidemia to assess the degree of association among subjects with Type 2 DM. Medcalc 12.2.1.0 version software was used for analysis of the Data.

### III. RESULTS

Out of total 272 type 2 diabetes subjects included in this study, majority (65.07%) were from age group 30 to 60 years with slight male predominance (M:F=1.2). Likewise proportion of urban cases predominate over rural i.e. 70.59% v/s 29.41%. Majority (51.1%) of cases were educated upto secondary level. Likewise 65.44% were having family income <10,000. (Table 1)

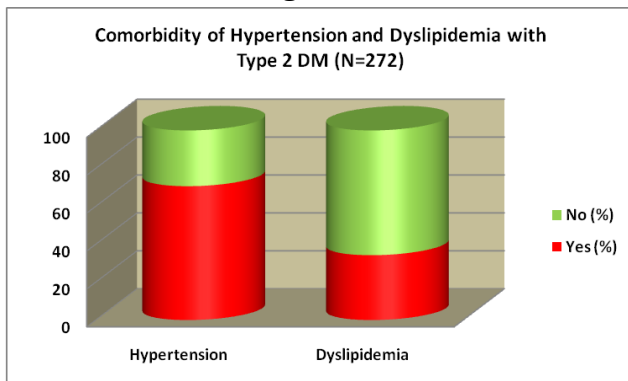
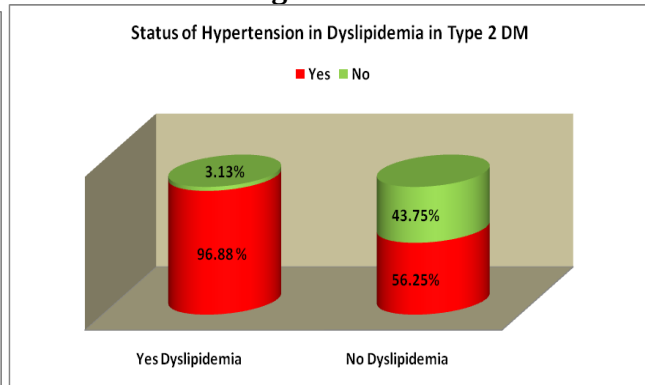
**Table 1**

**Socio-demographic Characteristics of the Subjects with Type 2 Diabetes**

| Characteristics             |                                  | Number (N = 272) | Percentages ( % ) |
|-----------------------------|----------------------------------|------------------|-------------------|
| <b>Age<br/>( in years )</b> | 30 -60                           | 177              | 65.07             |
|                             | > 60                             | 95               | 34.93             |
| <b>Sex</b>                  | Male                             | 147              | 54.04             |
|                             | Female                           | 125              | 45.96             |
| <b>Religion</b>             | Hindu                            | 222              | 81.62             |
|                             | Muslim                           | 50               | 18.38             |
| <b>Education</b>            | Upto primary level               | 78               | 28.68             |
|                             | Above Primary to secondary level | 139              | 51.1              |
|                             | Higher level                     | 55               | 20.22             |
| <b>Income (₹)</b>           | ≤ 10000                          | 178              | 65.44             |
|                             | > 10000                          | 94               | 34.66             |
| <b>Residence</b>            | Urban                            | 192              | 70.59             |
|                             | Rural                            | 80               | 29.41             |

Hypertension was present in 192 (70.59%) and dyslipidemia was present in 93 (34.19%) of type 2 diabetes patients. (Figure 1)

When risk of Hypertension with Dyslipidemia was revealed it was found that there were 24.11 times more (Odds ratio = 24.111 with 95% confidence interval: 7.352 to 79.070, Chi-square 47.442 with 1 degree of freedom;  $p < 0.001$ ) chances to have hypertension in dyslipidemia cases in type 2 DM, which was found significant (Figure 2)

**Figure 1****Figure 2**

When association of Hypertension and Dyslipidemia with studied socio-demographic factors were revealed it was found that sex, education and residence of cases were not found to associated with both the diseases in type 2 DM whereas it was found significantly ( $p < 0.05$ ) more in younger age group and cases with less family income in comparison to their counterparts. (Table 2)

**Table 2**  
**Association of Socio-demographic factors with hypertension and dyslipidaemia**  
**among subjects with Type 2 Diabetes**

| Variables            | N            | Hypertension  |       |    |       | Dyslipidaemia |       |     |       |
|----------------------|--------------|---------------|-------|----|-------|---------------|-------|-----|-------|
|                      |              | Yes           | %     | No | %     | Yes           | %     | No  | %     |
| Age                  |              |               |       |    |       |               |       |     |       |
| 30 -60               | 177          | 135           | 76.27 | 42 | 23.73 | 74            | 41.81 | 103 | 58.19 |
| > 60                 | 95           | 57            | 60.00 | 38 | 40.00 | 22            | 23.16 | 73  | 76.84 |
| Chi square test      |              | 7.119 at 1 DF |       |    |       | 8.616 At 1 DF |       |     |       |
| P Value              | Significance | 0.008 S       |       |    |       | 0.003 S       |       |     |       |
| Sex                  |              |               |       |    |       |               |       |     |       |
| Male                 | 147          | 109           | 74.15 | 38 | 25.85 | 60            | 40.82 | 87  | 59.18 |
| Female               | 125          | 83            | 66.40 | 42 | 33.60 | 36            | 28.80 | 89  | 71.20 |
| Chi square test      |              | 1.559 at 1 DF |       |    |       | 3.761 at 1 DF |       |     |       |
| P Value              | Significance | 0.206 NS      |       |    |       | 0.052 NS      |       |     |       |
| Education            |              |               |       |    |       |               |       |     |       |
| Nil to primary level | 78           | 52            | 66.67 | 26 | 33.33 | 34            | 43.59 | 44  | 56.41 |
| Upto secondary level | 139          | 101           | 72.66 | 38 | 27.34 | 41            | 28.06 | 98  | 71.94 |
| Higher level         | 55           | 39            | 70.91 | 16 | 29.09 | 21            | 41.82 | 34  | 58.18 |
| Chi square test      |              | 0.868 at 2 DF |       |    |       | 4.597 at 2 DF |       |     |       |
| P Value              | Significance | 0.648 NS      |       |    |       | 0.1 NS        |       |     |       |
| Income               |              |               |       |    |       |               |       |     |       |
| ≤ 10000              | 178          | 114           | 64.04 | 64 | 35.96 | 53            | 29.78 | 125 | 70.22 |
| > 10000              | 94           | 78            | 82.98 | 16 | 17.02 | 43            | 45.74 | 51  | 54.26 |
| Chi square test      |              | 9.729 at 1 DF |       |    |       | 6.188 at 1 DF |       |     |       |
| P Value              | Significance | 0.002 S       |       |    |       | 0.013 S       |       |     |       |
| Residence            |              |               |       |    |       |               |       |     |       |
| Urban                | 192          | 142           | 73.96 | 50 | 26.04 | 72            | 37.50 | 120 | 62.50 |
| Rural                | 80           | 50            | 62.50 | 30 | 37.50 | 24            | 30.00 | 56  | 70.00 |
| Chi square test      |              | 3.041 at 1 DF |       |    |       | 1.082 at 1 DF |       |     |       |
| P Value              | Significance | 0.081 NS      |       |    |       | 0.298 NS      |       |     |       |

When association of Hypertension and Dyslipidemia with studied disease related factors were revealed it was found that Hypertension and Dyslipidemia was found significantly ( $p < 0.05$ ) more in cases with positive family history of disease. it was also revealed that proportion of both diseases significantly ( $p < 0.05$ ) increases with the increase on serum HbA1c level and duration of illness. Proportion of both diseases were found significantly ( $p < 0.05$ ) more in cases who were on both (Oral + Injectable) treatment than cases on only oral or only injectable treatment. (Table 3)

**Table 3.**  
**Association of various disease related factors with Hypertension and Dyslipidaemia**  
**in subjects with type 2 DM**

| Variables                                  | N   | Hypertension        |       |    |       | Dyslipidaemia |       |     |         |
|--------------------------------------------|-----|---------------------|-------|----|-------|---------------|-------|-----|---------|
|                                            |     | Yes                 | %     | No | %     | Yes           | %     | No  | %       |
| Family History                             |     |                     |       |    |       |               |       |     |         |
| Present                                    | 106 | 90                  | 84.91 | 16 | 15.09 | 68            | 64.15 | 38  | 35.8491 |
| Absent                                     | 166 | 102                 | 61.45 | 64 | 38.55 | 28            | 16.87 | 138 | 83.1325 |
| Chi square test<br>P Value    Significance |     | 16.038 at 1 DF<br>S |       |    |       |               |       |     |         |

When association of Hypertension and Dyslipidemia with studied personal attributes were revealed it was found that although smoking was not found to associated with both the diseases in type 2 DM but both diseases were found significantly ( $p < 0.05$ ) more in alcoholics and obese cases in comparison to their counterparts. (Table 4)

**Table 4**  
**Association of Personal Attributes with Hypertension and Dyslipidaemia**  
**in subjects with type 2 DM**

| Variables                                  | N   | Hypertension        |        |    |       | Dyslipidaemia       |       |     |       |        |
|--------------------------------------------|-----|---------------------|--------|----|-------|---------------------|-------|-----|-------|--------|
|                                            |     | Yes                 | %      | No | %     | Yes                 | %     | No  | %     |        |
| Smoking                                    |     |                     |        |    |       |                     |       |     |       |        |
| Yes                                        | 88  | 62                  | 70.455 | 26 | 29.55 | 36                  | 40.91 | 52  | 59.09 |        |
| No                                         | 184 | 130                 | 70.652 | 54 | 29.35 | 60                  | 32.61 | 124 | 67.39 |        |
| Chi square test<br>P Value    Significance |     | 0.012 at 1 DF<br>NS |        |    |       | 1.451 at 1 DF<br>NS |       |     |       | 0.228  |
| Alcohol                                    |     |                     |        |    |       |                     |       |     |       |        |
| Yes                                        | 90  | 82                  | 91.11  | 8  | 8.89  | 56                  | 62.22 | 34  | 37.78 |        |
| No                                         | 182 | 110                 | 60.44  | 72 | 39.56 | 40                  | 21.98 | 142 | 78.02 |        |
| Chi square test<br>P Value    Significance |     | 25.830 at 1 DF<br>S |        |    |       | 40.964 at 1 DF<br>S |       |     |       | <0.001 |
| BMI                                        |     |                     |        |    |       |                     |       |     |       |        |
| Normal                                     | 128 | 70                  | 54.688 | 58 | 45.31 | 35                  | 27.34 | 93  | 72.66 |        |
| Overweight                                 | 104 | 85                  | 81.731 | 19 | 18.27 | 37                  | 35.58 | 67  | 64.42 |        |
| Obese                                      | 40  | 37                  | 92.50  | 3  | 7.50  | 24                  | 60.00 | 16  | 40.00 |        |
| Chi square test<br>P Value    Significance |     | 31.058 at 2 DF<br>S |        |    |       | 14.237 at 2 DF<br>S |       |     |       | <0.001 |

#### IV. DISCUSSION

Out of 272 type 2 diabetes subjects included in this study, Hypertension was present in 192 (70.59%) and dyslipidemia was present in 93 (34.19%) of type 2 diabetes patients. Madhu, et al<sup>10</sup> in Mysore and Fayzeh M. Mubarak<sup>11</sup> in Jordan observed a prevalence rate of hypertension being 64.4 % and 72.4% respectively in their studies among diabetes which is well comparable to present study. Mayur Patel et al<sup>12</sup> in their study in Ahmedabad and Dhananjay Yadav et al<sup>13</sup> in their study in Gwalior reported a low prevalence of hypertension among diabetes ( 45.1% and 49% respectively) than present study.

In study conducted by D. Prabhakaran et al<sup>14</sup> in Delhi, Hypercholesterolemia (total cholesterol  $\geq 200$  mg/dl) was observed in 30.1% and hypertriglyceridemia (serum fasting triglycerides  $\geq 150$  mg/dl) in

38% which is also comparable to this present study. Dhananjay Yadav et al<sup>13</sup> and Mayur Patel et al<sup>12</sup> observed a prevalence of dyslipidemia 64.1% and 705 respectively. And L Patnaik et al<sup>15</sup> reported 50% of diabetes were having dyslipidemia whereas in this present hypertension was found in 96.88% of dyslipidemia cases.

In present study, Hypertension was found in 135 out of 177 subjects (77.27%) in age group 30 to 60 years as compared to 57 out of 95 (60%) in > 60 yrs age group and this association was found significant ( $P < 0.5$ ). Madhu, et al<sup>10</sup> in Mysore also reported a significantly high number of hypertensives were in the age group of 41-59 years ( $P = 0.02$ ), and no significant association between prevalence of hypertension and sex ( $P = 0.14$ ). but no significant association was found between sex and HTN. Chinedu and Nicholas<sup>16</sup> in their study noted no significant association between sex and HTN among diabetic subjects. Fayzeh M. Mubarak<sup>11</sup> in Jordan also observed that the prevalence among men was similar to that among women ( $P = 0.3$ )

Similarly dyslipidemia was found significantly higher in 30 to 60 yr age group (41.81 %) in comparison to > 60 yr age group (23.16%). Hypertension and dyslipidemia was found significantly higher in >10000 Rs income group (82.98% and 45.74% respectively) as compared to low income group (64.04% and 29.78% respectively) ( $P < 0.5$ ). In study by Fayzeh M. Mubarak<sup>(11)</sup>, Illiterate people were found to be at higher risk of hypertension compared to those with a high school or college education ( $P = .01$ )

Presence of family history was significantly associated with both hypertension and dyslipidemia and 84.91% and 64.15% diabetes subjects with positive family history were having hypertension and dyslipidemia respectively in present study.

Subjects suffering from hypertension and dyslipidemia also increased with increase in duration of illness and more than 70% and 40% diabetic patients with illness more than 12 months were having hypertension and dyslipidemia respectively and this association was found significant in present study. Fayzeh M. Mubarak<sup>(11)</sup> in Jordan also observed a significant relationship between duration of diabetes and hypertension. Mohamed Berraho et al<sup>(17)</sup> reported that Patients with duration of diabetes over 5 years were found to be at higher risk of hypertension compared to those with duration of diabetes less than 5 years ( $P < 0.01$ ). Similarly significant association was also seen with type of treatment and 91.14% and 48.39 % of subjects on both oral and injectables medication were suffering from hypertension and dyslipidemia respectively.

It was observed that 91.11% and 62.22% type 2 diabetes subjects with alcohol consumption were having hypertension and dyslipidemia respectively in present study and this association was found to be significant.

Association of BMI with hypertension and dyslipidemia was also found to be significant in this study and 92.5% and 60% of obese diabetes subjects were having hypertension and dyslipidemia respectively. Chinedu and Nicholas<sup>(16)</sup> also found that over weight and obese subjects had significantly higher rate of hypertension than normal weight subjects (74.4% vs. 41.7%,  $P = 0.0004$ ). Fayzeh M. Mubarak<sup>(11)</sup> in Jordan observed that Obese subjects had a significantly ( $P = .001$ ) higher rate of hypertension (76.6%) than both the overweight (69.9%) and normal weight (55.7%) groups L Patnaik et al<sup>(15)</sup> observed in their study that Hypertension was significantly higher in overweight or obese patients ( $X^2 = 9.294$ ,  $P = 0.010$ ). Mohamed Berraho et al<sup>(17)</sup> observed that Compared to the normal BMI group, the risk of hypertension increased by 3.09 among the obese group ( $P < 0.0002$ )

It was observed that 82.76% and 68.97% type 2 diabetes subjects with poor glycaemic control were having hypertension and dyslipidemia respectively in present study and this association was found to be significant. Abdul-karim m.al-khawlani et al <sup>(18)</sup> in Yemen observed that the percentage of hypertension among non-controlled blood glucose patients was 60.8% (93 out of 153), while it was 41.7% (15 out of 36) among the controlled blood glucose patients. The difference between the two groups was statistically significant ( $P = 0.049$ ) Figure1.

It was found that there is 24 times more risk of hypertension in type 2 DM patients having dyslipidemia (OR= 24.111 with 95 % C.I. = 7.352 to 79.07 ).

## V. CONCLUSIONS

Hypertension was present in more than two third and dyslipidemia was present in more than one third of cases with type 2 diabetics in present study. Both hypertension and dyslipidemia were significantly associated with age, family income, and presence of family history, duration of illness, type of treatment, consumption of alcohol, BMI, Hba1c level.

Diabetic patients should develop a healthy life style including daily physical activity and healthy eating. They should be in regular treatment and follow up so that diagnosis and management of complication can be made at an earliest. Government should also increase awareness and encourage people to follow a healthy life style and quit alcohol through IEC activities.

## CONFLICT

None declared till date.

## REFERENCES

1. Global status report on noncommunicable diseases 2014. Geneva, World Health Organization, 2012.
2. World Health Organization. Global Health Estimates: Deaths by Cause, Age, Sex and Country, 2000-2012. Geneva. WHO, 2014.
3. (3) Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Med*, 2006, 3(11):e442
4. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C. Epidemiology of type 2 diabetes: Indian scenario. *Indian J Med Res* 2007;125:217-30.
5. Kaplan NM, Lieberman E. Hypertension and diabetes obesity and dyslipidemia in clinical Hypertension. 7th ed. New Delhi: B.I. Waverly Pvt. Ltd.; 1998. p. 244-7.
6. American Diabetes Association. Standards of medical care in diabetes. *Diabetes Care* 2009; 32:513-6.
7. Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) [special communication]. *JAMA* 2001;285:2486-2947.
8. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report [special communication]. *Circulation* 2002; 106: 3143- 3421.
9. US Department of Health and Human Services: JNC7 Express The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure. USA: National Institutes of Health National Heart, Lung, and Blood Institute. NIH Publication No.03-5233; 2003.



10. Madhu, *et al.*: Risk of stroke and myocardial infarction among diabetics with high blood pressure Journal of Mahatma Gandhi Institute of Medical Sciences March 2014 | Vol 19 | Issue 1
11. Fayzeh M. Mubarak et al. Hypertension among 1000 patients with type 2 diabetes attending a national diabetes center in Jordan. Ann Saudi Med 2008; 28(5): 346-351
12. Mayur Patel, Ina M. Patel et al. Profile of the subjects with Diabetes: A hospital-based observational study from Ahmedabad, Western India/ <http://www.ephysician.ir/index.php/browse-issues/year-2011-volume-3>
13. Dhananjay Yadav, Meerambika Mishra et al. Prevalence of Dyslipidemia and Hypertension in Indian Type 2 Diabetic Patients with Metabolic Syndrome and its Clinical Significance. Osong Public Health Res Perspect 2014 5(3), 169e175 <http://dx.doi.org/10.1016/j.phrp.2014.04.009>
14. D. Prabhakaran, Pankaj Shah, et al. Cardiovascular risk factor prevalence among men in a large industry of northern India; The National Medical Journal Of India; vol. 18, no. 2, 2005
15. L Patnaik, S Pattnaik, T Ghosh, A K Sahoo, T Sahu. Coronary Heart Disease Risk Factors Among Diabetic Patients Attending A Tertiary Care Hospital – A Cross Sectional Study. The Internet Journal of Epidemiology. 2013 Volume 11 Number 1.
16. Chinedu and Nicholas: Hypertension and Body Mass Index Correlates in Diabetics Nigerian Journal of General Practice | Jan-Jun 2015 | Volume 13 | Issue 1
17. Mohamed Berraho et al. Hypertension and type 2 diabetes: a cross-sectional study in Morocco. The Pan African Medical Journal. 2012;11:52.
18. Abdul-karim m. al-khawlani et al. hypertension in yemeni patients with type ii diabetes and its association with vascular complications. heart views. volume 10 no.2 june 2009 – august 2009