

Risk factors assessment for Type-II Diabetes Mellitus

M. Adak, S. Nazri

Department of Biochemistry, Faculty of Medicine, 7th April University, Zawia, Libya and National Medical College and Teaching Hospital, Birgunj, Nepal

Correspondence to: Dr. Manoranjan Adak, Department of Biochemistry, Faculty of Medicine, 7th April University, Zawia, Libya

e-mail: manoranjanadak@rediffmail.com, mradak1962@yahoo.co.in

Introduction: Diabetes mellitus is a group of metabolic abnormality often deliberating with sever complications of retinopathy, nephropathy and microangiopathy¹, which is one of the most common endocrine disorders in all populations and all age groups.

Materials and Methods: This is a retrospective study. A total of 1118 adult subjects were enrolled in the OPD in NMCTH. The case records of the patients of both genders aged range from 20-70 years. A definitive diagnosis was made based on clinical features, fasting blood sugar, post- Prandial blood sugar and lipid profiles estimation.

Results: Out of total patients, 142 were male and 71 were female Type –II diabetes patients. Male diabetes was maximum in 41-50 years age groups.

Associated risk factors and co-morbid conditions were analyzed. Factors like physical activity, socio-economical status, family history, obesity have shown statistically significant association with diabetes mellitus. About 42 % have systolic BP> 140 mm of Hg and 47 % have diastolic BP> 80 mm of Hg.

Conclusion: This study showed a trend of diabetes with age in both sexes, reaching the highest in the age 41-50 years. Based on our study, we may concluded that these factors need to be addressed in prevention and control strategies in this area.

Key words: Type-II diabetes mellitus, blood sugar level, hypertension, dyslipidemia.

Introduction

Diabetes mellitus is a group of metabolic abnormality often deliberating with sever complications of retinopathy, nephropathy and microangiopathy¹, which is one of the most common endocrine disorders in all populations and all age groups. It is characterized by derangements in carbohydrates, lipids and protein metabolism due to complete or relative insufficiency of insulin secretion and/or its action². Incidence of this chronic disease is spectacularly increases day by day throughout the globe. The prevalence of diabetes in developing countries is closely associated with industrialization, socio-economic

status, urbanization and changing life-style³. According to a study by WHO an estimated 140 million people worldwide suffer from diabetes and this number is expected to rise to at least 300 million by the year of 2025⁴. Recent studies have shown that among the developed countries like India has the largest diabetic population in the world⁵. A group of workers conducted a series of field survey of diabetes in urban and rural areas of Nepal and reported an approximately one third of the people in the age of 40 years and above in urban areas have greater tendency towards diabetes⁶. At present, diabetes has been noted to be increasingly common in various hospital of Nepal^{7,8}. Type-II diabetes mellitus is much more common than diabetes mellitus Type-I and

severity of Type-II diabetes mellitus is about 85%⁹. Both genetic and environmental factors are important in the development of the Type -II diabetes mellitus¹⁰⁻¹². These external factors are rectifiable and the evidence that correction of these factors can bring down the risk of Type-II diabetes mellitus by up to 91%^{13,14}. Thus, we conducted the study to find out the various risk factors in the causation of Type-II diabetes mellitus in the patients attending the OPD of National Medical College & Teaching Hospital, Birgunj, Nepal.

Material and Methods

Subjects: A hospital based case control study was carried out in clinically suspected patients with common symptomatic disease like fever, skin disease, diarrhea, etc and diabetes attending at out patient department (OPD) of National Medical College & Teaching Hospital, Birjung. The diabetic cases were selected by applying systemic random sampling technique and selecting every 6th patient attending OPD. Thus total number of patients 1118 (male 620 and female 498) subject were available for study. Non- diabetic patients as control were selected by matching of age and sex from other patients attending OPD.

Data on risk factors for diabetes mellitus were recorded on a structured questionnaire. Occupation was categorized as per Kappa Swamy's scale¹⁵. Income was categorized as per classification used by National Council of Applied Economic Research¹⁶. Nutritional status was evaluated using WHO's recommendation¹⁷. The anthropometric measurements (weight and height) were recorded and body mass index (BMI) were calculated on the basis of National Health and Nutritional Examination Surevy¹⁸. The physical activity was characterized by the following heads of sedentary, moderate and heavy worker¹⁹.

Blood Collection:

Fasting Blood Sugar (FBS) and Lipid Profiles – About 5 ml over night (10-12 h) venous blood samples was collected under aseptic condition from each individual. 1.5 ml blood

was taken in sodium fluoride vial for estimation of fasting blood sugar and rest was used for lipid profiles.

Post-Prandial Blood Sugar (PPBS) – After taking of high carbohydrate diet (150 g), venous blood sample (5 ml) was collected from individual after 2 h interval under aseptic condition in sodium fluoride vial.

Estimation:

Blood Sugar – Blood sugar (glucose) level was estimated by GOD-POD method using Bio-Kit (Ranbaxy) by semi - automated clinical chemistry analyzer (RANLAB/ Model-125) and expressed as mg/dl.

Serum Lipid Profiles – Total serum cholesterol was analyzed using cholesterol oxidase phenol 4 - aminophenazone peroxidase (COD-PAP) enzymatic method, triglycerides by glycerol phosphate oxidase - peroxidase (GPOP) method, high density lipoprotein cholesterol (HDL-C) fraction was estimated after manganese-heparin precipitation using semi-autoanalyzer. Low density lipoprotein cholesterol (LDL-C) was calculated by Freidelwald's equation²⁰.

Statistical Analysis – All results were expressed in Mean \pm SD. One way analysis of variance (ANOVA) was used to test the significance of difference.

Results

It is a hospital based cases control study of Type-II diabetes mellitus. A total of 1118 adult subjects were enrolled in the OPD in National Medical College, Birjung. Regarding sex out of total patients, 620 patients were male and 498 patients were female. Age of the patients were consider from 20-70 years and they were divided into five groups with age of 10 years interval. It has been found from Table-I that out of total patients, 213 (19%) patients were Type-II diabetes. On closer observation, it has been found that 142 (66.7 %) were male patients and 71 (33.3%) were female patients. So, maximum male patients are noticed as diabetes in 41-50 years age.

Table 1: Age and sex distribution of Type – II Diabetes Mellitus

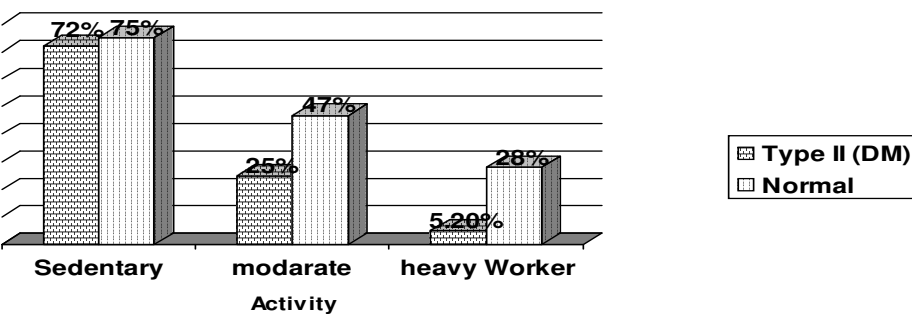
Age group (Year)	Male		Female		Total
	Total patients	Type -II DM Patients	Total patients	Type -II DM Patients	Type II DM
20 – 30	116	8 (5.6%)	119	8 (11.3%)	16 (7.5 %)
31 – 40	84	12 (8.5%)	148	12 (16.9%)	24 (11.4%)
41 – 50	148	68 (47.9%)	129	25 (35.2%)	93 (43.7 %)
51 – 60	71	30 (21.1%)	72	14 (19.7%)	44 (20.8 %)
61 – 70	201	24 (16.9 %)	30	12 (16.9%)	36 (16.7 %)
	n = 620	n = 142 (66.7%)	n = 478	n = 71 (33.3%)	n = 213 (100%)

Risk factors of Type-II DM

Fasting blood sugar (FBS) and post- prandial blood sugar (PPBS) were depicted in Table II & III. The values of FBS and PPBS in study groups were found to be progressively increasing with age. Type –II diabetes of male patients in 41-50 years age groups have a higher blood sugar of FBS (174.81 ± 12.03 mg%) and PPBS (251.79 ± 13.65 mg%) and the value was statistically significant ($p < 0.001$). In the same age groups of female patients also have a statistically significant ($p < 0.01$) rise of FBS (172.70 ± 10.06 mg %) and PPBS (211.19 ± 12.09 mg %) in comparison to control groups.

From Fig-2, it has been found that a significant association exist between diabetes and religion. Approximately 67 % diabetes belongs to Hindu and 21 % were in Muslim religion.

Fig. 2: Type – II Diabetes Mellitus VS Religion



Physical activities of the Type-II diabetes were given in Fig-1. Then results showed that the prevalence of diabetes in sedentary workers (72 %) while the moderate workers were only 25 % in respect to normal patients. Risk factor of diabetes in heavy workers (5.2%) was less significant.

Higher economic class (income > Rs.20, 000 pm) was found to be a significant risk factor and probably influence the occurrence of 43.7% Type-II diabetes (Fig-3). The occurrence of diabetes decreases with decreasing monthly income.

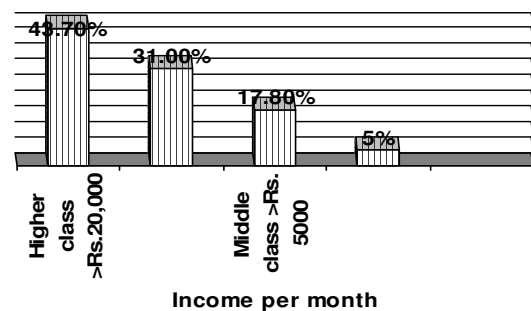


Fig. 1: Type-II Diabetes Mellitus VS Physical Activity

Fig. 3: Type – II Diabetes Mellitus VS Economic Status

It was also notice in Fig-4, Type-II diabetes mellitus was significantly associated with urbanization. The prevalence of diabetes was more among people living urban areas (61.1%) than in rural areas (23.9%).

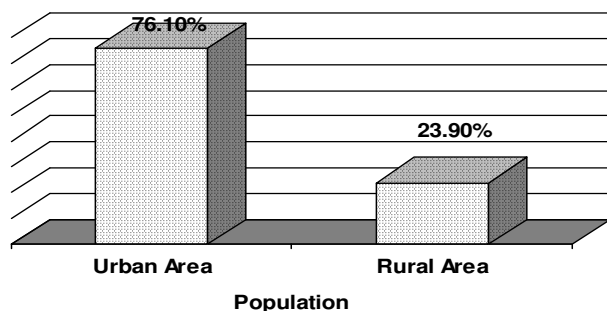


Fig. 4: Incident of Type-II Diabetes urban VS rural area

Obesity have long been accepted with a strong correlation to body fat content and it magnitudes depend on body mass index (BMI). From the study showed in Fig- 5, 53% of Type-II diabetic patients have normal BMI (19-23.7 kg/m²) where as 32% were overweight (BMI = 24-30kg/m²) and only 13%of the diabetic population were found to have obesity (BMI>30 kg/m²).

Fig. 5: Obesity VS Type – II Diabetes Mellitus patients

In our study, smoking habits of Type-II diabetic patients showed in Fig-6, indicates about 76% smokers were identified as significant risk factor for diabetes in compared with non-smokers (24%). Among the smokers, 35 % Type-II diabetes were found alcoholic .Other smokers like cigarettes, tobacco chewers, etc. were also found diabetes.

Family history of Type –II diabetes were found to be an important risk factor showed in Fig-7. Though there was an irregular percentage change in diabetes with different age groups but a high values was observed in 41-50 years age group (21%).

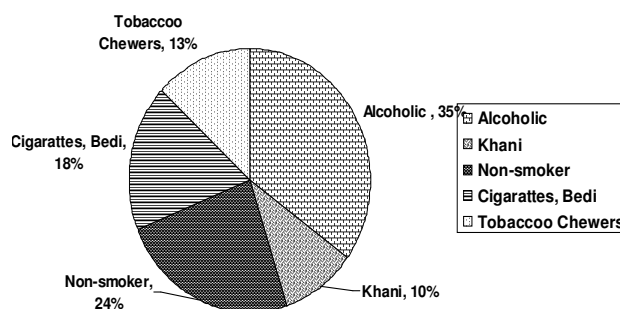


Fig. 6: Smoking habits of Type – II Diabetes Mellitus patients

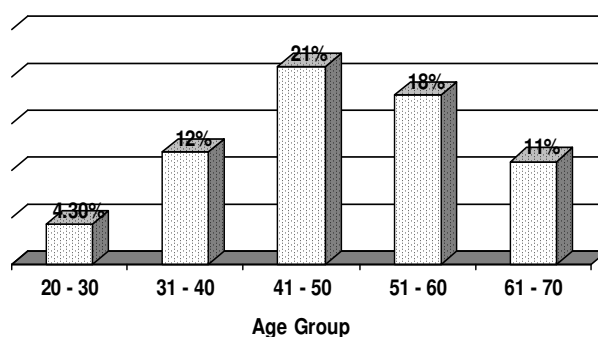


Fig. 7: Family history of Type –II Diabetes Mellitus patients

Out of 213 Type –II diabetes mellitus, 35% have systolic BP ranging from 130-140 mm of Hg, 42% systolic BP 140-150 mm of Hg, 22% have systolic BP 150-160 mm of Hg and 8% have systolic BP between 160-170 mm of Hg (Fig-8) where as 45% cases have diastolic BP ranging from 70-80 mm of Hg, 23% have diastolic BP 80-90 mm of Hg, 10% have diastolic BP between 90-100 mm of Hg and only 3% have diastolic BP 100-110 mm of Hg (Fig-9).

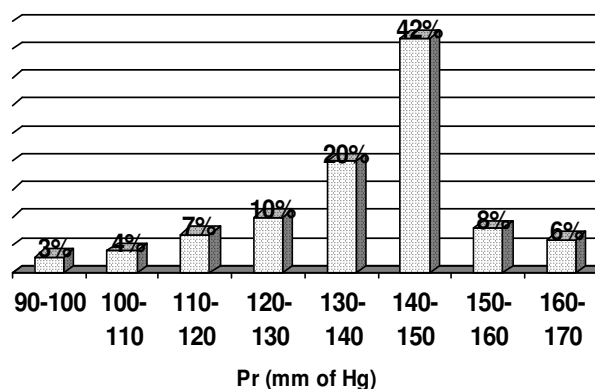


Fig. 8: Systolic blood pressure of Type – II Diabetes Mellitus patients

Risk factors of Type-II DM

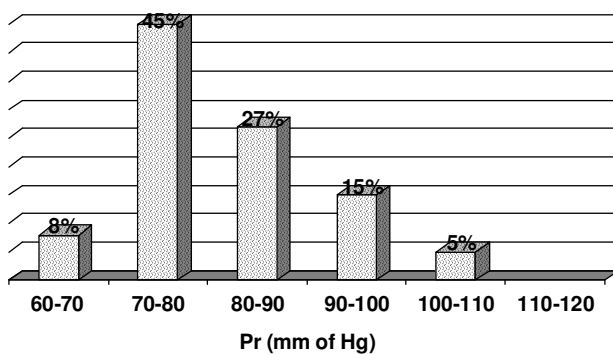


Fig. 9: Diastolic blood pressure of Type – II Diabetes Mellitus patients

Most of the Type-II diabetic male patients (54.9%) have desirable serum cholesterol level (150-200 mg/dl) and 29.6% have borderline level (200-250 mg /dl). 9.2% of the study cases were found to have serum cholesterol level 250-300 mg /dl where as 6.3% have > 300 mg/dl . 31 % of the male patients have normal serum triglycerides (TG) level (150-200 mg/dl) where as 69% have high serum TG level. High level of TG clearly showed 34.5% have TG 200-250 mg/dl, 24.6% have 250-300mg/dl and only 9. 9% have serum TG > 300 mg/ dl. Both serum cholesterol and TG levels (> 300 mg / dl) were found in 11.3 % in female patients. About 43 % female diabetic patients have normal serum cholesterol as well as TG level. Borderline level of TG was found little bit more (18.3%) than cholesterol (14.1%) in female.

However HDL-C level of Type –II diabetes mellitus in male was found to 59.2% (<40 mg /dl) but approximately 30 % under normal rang (40-60 mg/dl) and 11.3% have > 60 mg/ dl where as in female 52.1% have <40 mg/dl, 35.2% of 40-60 mg /dl and only 12.7% of > 60 mg/dl. LDL- C level in male was found <100mg/dl (30.3%), 100-1239 mg/dl (50.7%), 130-159 mg/dl (11.9%) and e" 160 mg/dl and in case of female the value was found almost same level of male.

Discussion

Type-II diabetes mellitus was characterized by an important component of metabolic syndrome associated with hyperglycemia, dyslipidemia, obesity and hypertension. Worldwide prevalence and incidence of diabetes was increasing day by day. So it is a new challenge to us to assess the actual and prominent risk factor for Type-II diabetes mellitus .Therefore, various risk factor for Type-II diabetes mellitus were investigated through an age and sex matched case-control in hospital (NMCTH, Birjung) based study .Our study shows relatively high rate of Type –II diabetes mellitus in male compared to female. Diabetes normally depends on age and mostly developed in adults at the age of 40 years and its magnitudes was more at the age of 50 years²¹. Present study shows diabetes mellitus to be the most common in the age group of 41-50 years.

Regarding the blood sugar level of FBS as well as PPBS values in male and female diabetic patients in 41-50 years age are statistically significant. High blood sugar level have been correlated with increased cardiovascular diseases²².

The risk of diabetes was more in sedentary worker than moderate worker. This may be due to (i) changes in the life style, (ii) lack of physical exercise and (iii) change in mode of interaction between insulin and its receptors which leads to Type –II diabetes mellitus²³.

Though there was no strong evidence that religion as a noticeable risk factor but our study showed majority cases belong to Hindus (67 %). These findings clearly indicates that distribution of labour, economical status and proceeding of daily life may be the possible cause of diabetes.

Higher economic class was found to be a significant risk factor and probably influence the occurrence of diabetes mellitus indirectly through affluence, causing a change in diet, the amount of food consumed and life style has been found elsewhere²⁴.

Table 4: Cholesterol & triglycerides levels of Type – II Diabetes Mellitus patients

Sex	Cholesterol(mg/dl)				Triglycerides (mg/dl)			
	150-200	200-250	250-300	>300	150-200	200-250	250-300	> 300
Male	78 (54.9%)	42(29.6%)	13 (9.2 %)	9(6.3%)	44(31%)	49(34.5%)	35 (24.6%)	14(9.99%)
Female	31(43.7%)	22(31%)	10(14.1%)	8(11.3%)	30(42.3%)	20(28.2%)	13(18.3%)	8(11.3%)

Obesity was established a significant risk factor and independent risk factor for Type-II diabetes mellitus²⁵. It was found that about 28 times increase the risk of Type-II diabetes mellitus than non-obese individual²⁶. Obesity particularly central adiposity has long been accepted as a risk factor for Type-II diabetes mellitus and it has a strong correlation with body mass index (BMI)²⁷. An increase in BMI even at relatively low levels in previously normal weight individual greatly increases the risk of diabetes²⁸. Present study indicates that only 13% of Type-II diabetes was found to have obesity (BMI >30 kg/m²). Intake of high calories food and less physical activity may be the cause of obesity.

In our study the most significant risk factor for Type-II diabetes mellitus is associated with urbanization. The prevalence of diabetes was more among people living in urban areas than in rural areas in developing countries^{29, 30, 31}. The speculated reason for (a) ageing, (b) changes in life style and (c) underweight birth of baby which could lead to diabetes during adult stage.

An interesting observation came out from our study that cigarette smoking and alcohol consumption are major risk factor for diabetes. Some author suggested the smoking enhance the myocardial infraction and complications of peripheral vascular diseases with diabetes mellitus but exact mechanism is still unknown³² where as excessive intake of alcohol can increase the risk of diabetes by damaging the pancreas, liver and by promoting obesity³³.

Family history of diabetes was found to be a very important risk factor. It has been generally accepted that there is a strong genetic predisposition for Type-II diabetes mellitus. Our study shows 42% patients have systolic BP ranging from 140-150 mm of Hg and 47 % have diastolic BP > 80 mm of Hg which is reflecting hypertension as the commonest co-morbid condition associated with Type-II diabetes mellitus. Associated risk factor with diabetes either due to change of socio-economic status which might have hampered their daily life, and / or developed some unknown stress. Lipid abnormalities and diabetes have been acknowledge that cardiovascular complication are the principle cause of morbidity and mortality associated with the diabetic patients³⁴. The common pattern of dyslipidemia in diabetes is hypertriglyceridemia and reduced HDL-cholesterol level³⁵. The causal link between elevated LDL-cholesterol and coronary heart disease was also established³⁶. A study has shown that the prevalence of hyperlipidemia in Type-II diabetes can be as high as 70.0%³⁷ in comparison to Indian (55 %) of diabetic population³⁸. One more study conducted in Finland showed higher risk of myocardial infraction subjects with Type-II diabetes than

in non- diabetic subjects with myocardial infraction³⁹. Present study shows that 69% of Type –II diabetic male and 57.9% of female patients have hypertriglyceridemia (TG > 200 mg %). Hypercholesterolemia (cholesterol > 250 mg %) was found more in female than male. Regarding HDL-cholesterol it was found >50 % male as well as female have low serum HDL-C (< 40 mg%) but very less number diabetic patients have elevated level of LDL- C.

Conclusion

It is clear that sedentary life style ,socio-economic status, obesity, urbanization ,smoking, stress, family history were identified as the important risk factors for Type-II diabetes mellitus . Based on our retrospective study, we may concluded that these factors need to be addressed in prevention and control strategies in this area

Acknowledgments

Our sincere thanks go to Prof Dr J N Shivapuri, HOD, Dept. of Biochemistry, Principal, Vice Principal and Board of Directors of National Medical College for their invaluable support and inspiration. The authors thank to laboratory technicians for their help without which this study could not have been possible.

References

1. Rameshkumar K, Shah SN, Goswami DB, Mohan V, Bodhankar SL. Efficacy and toxicity of vanadium nicotinate in diabetic rats. *Toxicol Int* 2004; **1**: 75-80.
2. Balkau B, Charles MA, Eschwege E. Discussion epidemiologique des nouveauxciteres du diabete. *Mt. Endocrinologic* 2000; **2**: 229-34.
3. Zimmet P. Challenge in diabetes epidemiology from west to the rest. *Diabetes Care* 1992; **15**: 232-52.
4. WHO. Diabetes mellitus. Fact sheet number 138 and 236, Geneva 1999.
5. King H, Anbert RE, Herman WH. Global burden of diabetes 1995-2025; prevalence, numerical estimates and projection. *Diabetes Care* 1998; **21**: 1414-31.
6. Singh DL, Bhattarai MD. High prevalence of diabetes and impaired fasting glycemia in urban Nepal. *Diabetes Med* 2003; **20**: 170-71.
7. Karki P, Bhandary S, Korean M, Braind K. Diabetes and its macrovascular and microvascular manifestatious among Micronesian popoulations. *J Nepal Med Assoc* 2003; **42**: 337-340.

Risk factors of Type-II DM

8. Dhungel S, Devkota KC, Chhetri P, Bhattarai P, Shrestha A. Study of type 2 diabetes mellitus cases at Nepal Medical College Teaching Hospital. *Nepal Med Coll J* 2004; **6**(2): 92-97.
9. World Health Organization (WHO). Diabetes mellitus. Report of a WHO study group. WHO Technical Report Series (TRS) 727, Geneva. WHO 1985; **7**:98.
10. Zimmet P. Type 2 (Non Insulin Dependent) diabetes . An epidemiological overview. *Diabetologica* 1982; **22**:399-411.
11. Ramachandran A, Snehelatha C, Satyavani K, Svasankar S, Vijay V . Cosegregation of obesity with familial aggregation of type 2 diabetes mellitus. *Diabetes Obes Metab* 2000; **2**(3): 149-154.
12. Bennett PH, Rushforth NB, Miller M, LeCompte PM. Epidemiologic studies of diabetes in the Pima Indians . *Recent Prog Horm Res* 1976; 333-376 .
13. Pinkey J. Prevention and care of type 2 diabetes. *B M J* 2002; **325**: 232-33.
14. Hu FB, Maouson JE, Stampfer MJ, Colditz G, Tiu S, Soloman CG et al ; . Diet, Life style and risk of Type-II diabetes mellitus in women. *N Engl.J. Med* 2001; **345**, 790-797.
15. Kuppu Swamy B. Manual of Socio-economical Status Scale (urban). Mansayam, 32, Netaji Subash Marg ,Delhi 1976
16. Statical Outlines of India (1995-96) TATA Service Ltd. Department of Economics and Statistics. 1997
17. World Health Organisation. Measuring Nutritional Status. Geneva , WHO 1985
18. World Health Organisation : Physical Status .The use and interpretation of anthropometry technical report . Series No-854, Geneva, WHO 1995.
19. Gopalan C, Rama Sastri BV, Balasubramanian C. Nutritive values of Indian Foods. National Institute of Nutrition .Indian Council of Medical Research, Hyderabad 1991; p- 10.
20. Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. *Clin Chem.* 1972; **18**: 499-502.
21. National Institute of Diabetes and Digestive and Kidney Diseases. National Institute of Health. Diabetes Overview. NH Publication No.03- 3873 May 2003.
22. DECODE Study group. *Lancet* 1999; 254: 617-21.
23. Park K. Park's text book of preventive and social medicine. Jabalpur , Banarsidas Bhanot 2002; 296-300.
24. Bennett PH, Rushforth NB, Miller M, LeCompet PM .Epidemiologic studies of diabetes in the Pima Indians *Recent Prog Horm Res* 1976; 333-376.
25. Mokdad AH, Bowman BA, Ford ES, Vinicor F, Marks JS, Koplan JP. The continuing epidemics of obesity and diabetes in the united State. *JAMA* 2001; **286**: 1295-2000.
26. Colditz G, Willett WC, Stampfer MT, Manson JE, Hennekens CH, Arky RA, et.al. Weight as a risk factor for clinical diabetes in women. *Am J Epidemiol* 1990; **231**: 501-513.
27. WHO Report 2002.Reducing risks, promoting healthy life. Geneva.WHO & DELHI.AITBS2003; 60.
28. International Diabetes Federation and International Association for the study of obesity. Diabetes and obesity. Brussels: International Diabetes Federation 2004; 25.
29. Karki P , Baral N, Lamsal M. et.al . Prevalence of non-insulin dependent diabetes mellitus in urban areas of eastern Nepal . *Southeast Asian J Throp Med Public Health* 2000; **31**: 163-66.
30. Ramaiya KL, Kodali VR, Alberti KG . Epidemiology of diabetes in Asian of the Indian sub-continent. *Diabetes Metab Rev* 1990; **6**: 125-46.
31. Vannaseang S , Viriyavejakul A, Pongvarin N. Prevalence of diabetes mellitus in urban community of Thailand. *J Med Assoc Thai* 1986; **69**: 131-37.
32. Palumbo PJ, O'Fallon WM, Osmundson PJ. Progression of peripheral vascular and arterial disease in diabetes mellitus. What factors are predictive? *Arch Intern Med* 1991; **151**: 717-21.
33. WHO. Tech Rep Ser No.727, 1985.
34. American Diabetes Association. Diabetes mellitus: A major risk factor of cardiovascular diseases. *Circulation* 1999; 1132- 3.
35. Powers AC. Diabetes mellitus. *Harrison's Principles of Internal Medicine*. 15th Edition. vol- 2, chap-333, p- 2109-37.
36. Castelli WP, Anderson K, Wilson PW. et.al. Lipid and risk of coronary heartr disease : The Farmingham study. *Ann Epidemiol* 1992; **2**: 23-8.
37. Ganda OP. Pathogenesis of macrovascular diseases

including the influence of lipids. Joslin's Diabetes mellitus. 12th Edition. Marble A et.al. , Lea and Febiger, USA 1985; 217-50.

38. Newsletter. Vol-1, No-3, p-1. Pfizer Ltd. India publication.
39. Haffner S, Lehto S, Ronnema T. et.al. Mortality from coronary heart disease in subjects with Type 2 diabetes and in non-diabetes subjects with and without prior myocardial infarction. New Engl J Med 1998; **339**: 229-34.