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Difference of Clinical Parameters and Correlation between Type-1 and Type-2 Diabetes Mellitus (DM) Subjects in Bangladesh

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ABSTRACT

Type I and Type 2 diabetes are the two main types with types diabetes accounting for the majority (>85%) of total diabetes prevalence. Both forms of diabetes can lead to multisystem complications of microvascular endpoints including retinopathy, nephropathy and neuropathy and microvascular endpoints including is cadmic heart disease, stroke and peripheral vascular disease. The premature morbidity, mortality, reduced life expectancy and financial and other others costs of diabetes make if an important public health condition. The aim of this study was to observe the clinical condition and consequences patients with diabetes mellitus in Bangladesh. A descriptive cross-sectional study was conducted for the study. Data are collected from BIHS General Hospital. The results showed that, among 100 patients 20% patient was affected by Type-1 Diabetes Mellitus (DM) and 80% patient was affected by Type-2 Diabetes Mellitus (DM). In comparison between Type-1 and Type-2 DM patient's result showing that Fasting Plasma Glucose (FPG) and 2 hour ABF plasma Glucose range is slightly high in Type-1 DM than Type-2 DM. On the other hand, Creatinine, HbA1C, TSH, Total cholesterol (TC), Triglycerides (TG), HDL ranges are increased in Type-2 DM patient. In this study males are affected 62% and females are 32%. So the ratio between male and female is 2:3. More patients were found in the age between 50-60 years and has risk among 40-50 years. Eating the right foods and adopting other life style behaviors that promotes healthy blood sugar and insulin levels will give you the best chance at avoiding diabetes.

INTRODUCTION

Diabetes mellitus is a chronic disorder of glucose metabolism with serious clinical consequences. The multi system consequences of diabetes includes microvascular (retinopathy, nephropathy, neuropathy) and macrovascular (ischemic heart disease, stroke, peripheral vascular disease) end points. The prevalence of diabetes has been rising in the last few decades. Diabetes is now a global problem. The premature morbidity, morality, reduced, life expectancy and financial and other costs to the patients with diabetes their careers and health service make it important public health condition. Diabetes affects persons of all ages and races (Afroz *et al.* 2019).

The classification and diagnosis of diabetes are complex and have been the subjects of much consultation, debate and revision stretching over the past decades. The etiological classification of debates has now been widely accepted Type 1 and Type 2 diabetes are the 2 main types of diabetes and type 2 diabetes accounting for the majority (>85%) of total diabetes prevalence (Sato *et al.* 2009). Expert committees from the World Health Organization (WHO) and American Diabetes Association (ADA) have formulated, converged and diverged in their position on the diagnostic criteria for diabetes based on the measurement of fasting and 2h post load glucose but most recently there has been an ongoing debate on whether Glycated hemoglobin (HbA1C) should be used for diagnosing diabetes (WHO, 1999). Diabetes Mellitus (DM) is becoming a pandemic worldwide. WHO (World Health Organization) listed 10 countries to have the highest numbers of people with diabetes in 2000 and 2030. Bangladesh Appears in the list for both 2000 and 2030 with India, Pakistan, China, Japan, USA etc. According to a report, Bangladesh has 5.4 million of diabetic Subjects and the number is expected to increase to a staggering 11.1 million by 2030 (WHO, 1999). Several small-scale population-based studies conducted in Bangladesh at different time points have revealed an increasing trend of diabetes prevalence in rural and urban communities. A recent population bared study showed a significant increase in the prevalence of DM in rural Bangladesh from 2:3% to 6:8% over 5 years. This prevalence was higher than found in the previous rural studies of Bangladesh (Afroz *et al.* 2019).

Diabetes mellitus is referred to a group of diseases characterized by high glucose levels in blood. It is caused by deficiency in the production or loss of function of insulin, which can occur because of different reasons resulting in protein and lipid metabolic disorders. The aim of this study is to systematically review diabetes mellitus and determine the variation of different parameters of the patients with type 1 and type 2 diabetes. The result will help to check the complications, injuries and other conditions in the patient.

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Epidemiology of Type-1 and Type-2 Diabetes

Type-1 diabetes accounts for about 5% to 10% of all patients with diabetes. It is the most commonly diagnosed diabetes of youth (under 20 years of age) and causes ≥85% of all diabetes causes in this age group worldwide. It is estimated that 1106500 people aged 0-19 years have Type-1 diabetes worldwide with 132600 newly diagnosed cases each year. In USA, more than 17900 people aged under 20 years were newly diagnosed with Type-1 diabetes annually (annual rate for new cases about 21 in per 100000) (WHO, 1985). In a study of adults diagnosed with diabetes in the US in 2016 and 2017, type-1 diabetes accounted for 5.6 of cases. There is a significant geographic variation in the incidence of type-1 diabetes. It is more common in Europeans and less common in Asians. Thus, a child in Finland is 40 times more likely to develop Type-1 diabetes than a child in Japan and almost 100 times more likely to get the disease a child in the Zunyi region of China. Worldwide the incidence of type-1 diabetes is increasing by 3% every year although the reasons for this are unclear. One report showed a more rapid increase in nonwhite racial and ethnic group. Type-1 diabetes can present at any age with the highest incidence observed in children aged 10-14 years (Sato *et al.* 2009). It affects males and females equally. In 30th March 2020, the result of meta-analysis showed that the incidence of type-1 diabetes was 15 per 10000 people and the prevalence was 9.5% (95% cl: 0.7 to 0.12) in the world, which was statistically significant. As a result, insulin will be difficult to access and afford, specially, in underdeveloped and developing countries (Magliano *et al.* 2015).

Type-2 diabetes mellitus is one of the most common form of chronic disease globally. The rising burden of type-2 diabetes is now a major concern in health care worldwide. The global prevalence of diabetes mellitus is rapidly increasing as a result of population ageing, urbanization and associated lifestyle changes. The number of people with type-2 diabetes has more than doubled over the past 3 decades. In 2010, a research estimated 285 million people worldwide had type-2 diabetes mellitus and is projected to rise to 439 million by 2030 (Tharkar *et al.* 2010). The major burden of type-2 diabetes mellitus is now taking place in developing countries rather than in developed countries. 80% cases of type-2 diabetes mellitus worldwide live in less developed countries and areas. Asia has emerged as the "Diabetes Epidemic" in the worldwide as a result of rapid economic development, urbanization and nutrition transition over a relatively short period of time. Among the 10 countries with the largest numbers of people predicted to have diabetes mellitus in 2030. Amongst that 5 are in Asia. They are China, Pakistan, Indonesia and Bangladesh. In addition to Asia, the Gulf region in the Middle East and Africa are other hot spots for type-2 diabetes mellitus. A higher prevalence of type-2 diabetes mellitus in immigrants from the Middle East living in Sweden than in native Sweden has also been reported. The epidemic of type-2 diabetes mellitus is attributable to a mixture of genetic and epidemic predispositions and variety of behavioral and environmental risk factors (Kuzuya *et al.* 1997).

Pathophysiology of Diabetes Mellitus

Type-1 Diabetes Mellitus

Type-1 diabetes mellitus results from the description of pancreatic B- cells that is mediated by the immune system. Multiple genetic and environmental factors in variable combinations in individual patients are involved in the development of type-1 diabetes mellitus. Generic risk is defined by the presence of particular allele combinations, which in the major susceptibility locus (the HLA region) affect T cell recognition and tolerance to foreign and autologous molecules (Alberti *et al.* 1998). Multiple other loci also regulate and affect features of specific immune responses and modify the vulnerability of B- cells to inflammatory mediators8. Compared with the genetic factors, environmental factors that affect the development of type-1 diabetes mellitus are less well characterized but contact with particular micro-organism is emerging as an important factor. Certain infections might affect immune regulation, and the role of commensal microorganisms such as gut microbiota, coxsackie, rubella viruses are important (Toumi *et al.* 1993). Some evidence also suggests that nutritional factors are important. Multiple islet specific autoantibodies are found in the circulation from a few weeks to up to 20 years before the onset if clinical disease and this prediabetes phase provides a potential opportunity to manipulate the islet- specific immune response to prevent or postpone B- cell loss. The latest developments in understanding the heterogeneity of type-1 diabetes mellitus and characterization of major disease type might help in the development of preventive treatments (Vionnet *et al* 1992). Diabetes symptoms varies depending on how much blood sugar level is devoted in patients. Some people may sometimes not experience symptoms. In type-1 diabetes mellitus, symptoms tend to come on quickly and can be serve it includes: Thirst, Increased Hunger (Specially after eating), Dry Mouth, Upset Stomach and Vomiting, Frequent Urination, Unexpected Weight Loss (Even though eating and feel hungry), Heavy, Labored Breathing (Doctor may call this kussmaul respiration), Crankiness or Mood Changes, Fatigue and Weakness, blurred vision, Shaking and Confusion, Bedwetting in Children who's been Dry at Night (Murphy *et al.* 2008). Long term complications of diabetes develop gradually. The longer duration, the less controlled blood sugar, the higher risk of complications. Eventually diabetes complications may be disabling or life threatening. Heart and blood vessel disease (Cardiovascular disease), Never damage (Neuropathy), Kidney damage (Neuropathy), Eye damage, Foot damage, Skin and mouth infections, Pregnancy complications, Depression (Spyer *et al.* 2009).

Type-2 Diabetes Mellitus

Type-2 diabetes mellitus results from a defect in insulin

secretion and an impairment of insulin action in hepatic and peripheral tissues, especially muscle tissue and adipocytes. A post receptor defect is also present causing resistance to the stimulatory effect of insulin deficiency develops, unlike the absolute deficiency founds in patients with type-1 diabetes mellitus (Stride *et al.* 2002). The specific etiologic factors are not known but genetic input is much stronger in type-2 diabetes mellitus than in the type-1 form. In a state of health, normal glycaemia is maintained by fine hormonal regulation of peripheral glucose uptake and hepatic production. Impaired glucose tolerance (IGT) is a transitional state from normal glycaemia to frank diabetes but patient with Impaired Glucose Tolerance (IGT) exhibit considerable heterogeneity. Type- 2 diabetes or glucose intolerance is part of a dysmetabolic syndrome (Syndrome X) that includes insulin resistance, hyperinsulinemia, obesity, hypertension and dyslipidemia (Davies *et al.* 2018). Current knowledge suggests that the development of glucose intolerance or diabetes is initiated by insulin resistance and worsened by the compensatory hyperinsulinemia. Insulin resistance is not only predictive for type-2 diabetes and associated with myriad metabolic derangements in fasting conditions but also non-diabetic insulin resistant individuals are subjected to a similar adverse postprandial metabolic setting are cardio metabolic risk as those with type-2 diabetes mellitus (Mitrofanova *et al.* 2019). In addition, the prevalence of hypertension rises with exacerbation of stages of impaired glucose metabolism. However, only in the early stages of impaired insulin metabolism do hyperglycemia and hyperinsulinemia appear to be significant contributors to the presence of hypertension (Welsh *et al.* 2010) Signs and symptoms of type-2 diabetes often develop slowly. In fact, anyone can be living with type-2 diabetes for years and not knowing it. It includes- Increased Thirst, Frequent Urination, Increased Hunger, Fatigue, Blurred Vision, Slow Healing Sores, Frequent Infections (Gums/ Skin/ Vaginal), Numbers or Tingling in the Hands or Feet, Areas of darkened skin, usually in the armpits and neck, Presence of Ketones in Urine. And complications such as Cardiovascular disease (Heart and Blood vessel disease), Nerve Damage (Neuropathy) in limbs, Kidney disease (Neuropathy), Eye damage, Skin infection, Foot damage, Hearing impairment, Slow healing, Sleep apnea, Dementia (Alzheimer's Disease) (Mitrofanova *et al.* 2019).

METHODOLOGY

It was a cross-sectional study. It was a descriptive research that was mainly based on observation and data collection. The study conducted in Bangladesh Institute of Health Science (BIHS) and Bangladesh University of Health Sciences (BUHS). 100 Patients between the ages of 20 to 85 were approached to participate in the research. Sampling technique was purposive sampling. All data were collected in 26th December, 2020 to 4th March, 2021.

Laboratory Tests

In this study, some hematological and biochemical tests results were done to determine if there are any differences in the results between type-1 and type-2 diabetic patients. Normal values vary depending on age and type of diabetes. Different parameters measure the update health condition of a patient. In the laboratory, different amount of blood is needed for different kind of tests. The test was evaluated using a centrifuge which caused the contents of blood to separate anticoagulant was added to keep blood from clotting. Urine samples were also collected for tests. All tests were analyzed by an automated biochemistry analyzer machine for analysis

Sample Collection

A lab technologist had drawn blood from a vein, typically from the onside of patients elbow or from the back of hand. The technician cleaned the surface of the skin with an antiseptic and place an elastic or tourniquet around upper arm to help the vein swell with blood. Then inserted a needle in the vein and collect blood sample in one or more vials. The technologist removed the elastic band and cover the area with a bandage to stop the bleeding. Urine sample were collected in a vial. A container amount of urine was collected.

Statistical Analysis

Statistical analysis was done on an MS windows-based PC computer. The data were first keyed into a MS Excel spreadsheet and then analyzed by statistical package for the social sciences (SPSS).

Inclusion Criteria

Both men and women between 20 to 85 of age who are affected with type-1 and type-2 diabetes mellitus and are willing to participate voluntary and comply with the instruction of the study e.g. overnight fasting was considered eligible for the study.

Exclusion Criteria

People who are not qualified by inclusion criteria were excluded from study. Hey are given below-

- Pregnant women.
- Mentally disabled people.
- Physically disabled people

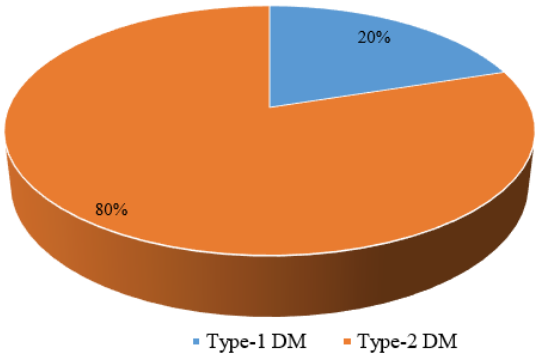

Figure 1: Distribution of Type-1 DM and Type-2 DM study subjects

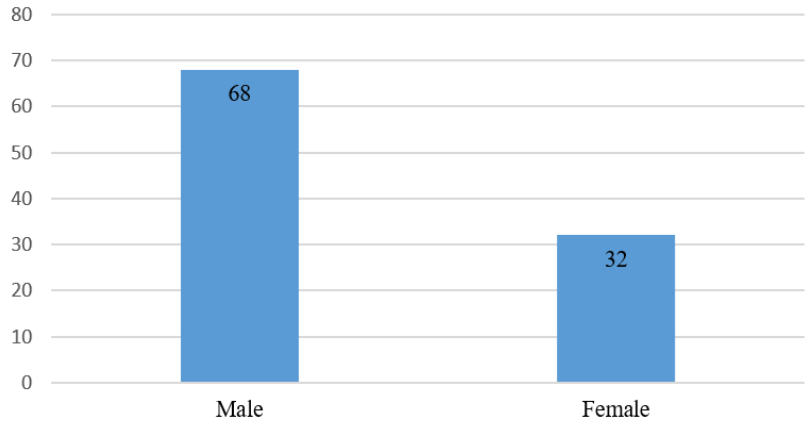

Figure 2: Percentage of type-1 and type-2 DM Male and Female subjects

RESULTS

Among 100 patients 20% patient was type-1 Diabetic patient and 80% patient was type-2 Diabetic patient. According to total sample pie chart are given below-

In This study sample was taken among 20-85 years old patient. This graphical presentation represents that, Type-1 diabetes mellitus is higher in younger peoples and Type-2 diabetes mellitus is higher in older peoples.

Among 100 patients 20% patient was type-1 Diabetic patient and 80% patient was type-2 Diabetic patient. Among those, Male patient is 62% and Female patient is 38%. This figure shows that male is more affected than female. In this study, Males are affected 62% and females are 38%. So, the ratio between male and female is 3:2.

Figure shows that age group distribution of type-1 and type-2 diabetes mellitus. Among 20-30 age group type-1 was 8 subjects and type-2 was 0 subjects. Accordingly, 30-40 age group type-1 was 10 subjects and type-2 was 7 subjects;

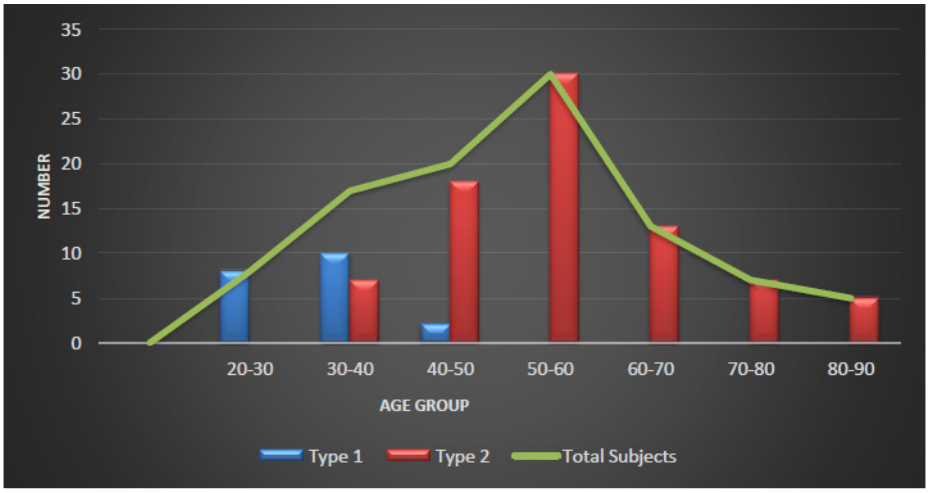

Figure 3: Age group distribution chart of Type 1 and Type 2 DM study subjects

Table 1: Mean value of different parameters among Type-1 and Type-2 diabetic subjects

Variable	Type-1 DM (n=20)	Type-2 DM (n=80)
Fasting Plasma Glucose	9.8 mmol/L	8.8 mmol/L
2 Hour ABF Plasma Glucose	11.2 mmol/L	10.2 mmol/L
Creatinine	1.7 mg/dL	2.3 mg/dL
HbA1c	6.7%	9.8%
TSH	2.75 mIU/L	5.28 mIU/L
Total Cholesterol (TC)	210 mg/dL	240 mg/dL
Triglycerides (TG)	132 mg/dL	169 mg/dL
HDL	42 mg/dL	65 mg/dL
LDL	155 mg/dL	190 mg/dL

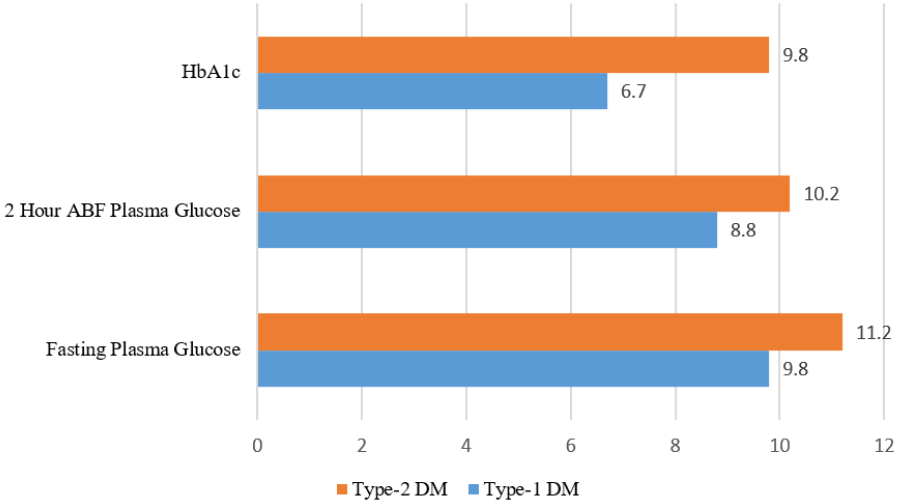

Figure 4: Comparison of different glucose parameters between type-1 and type-2 diabetic subjects

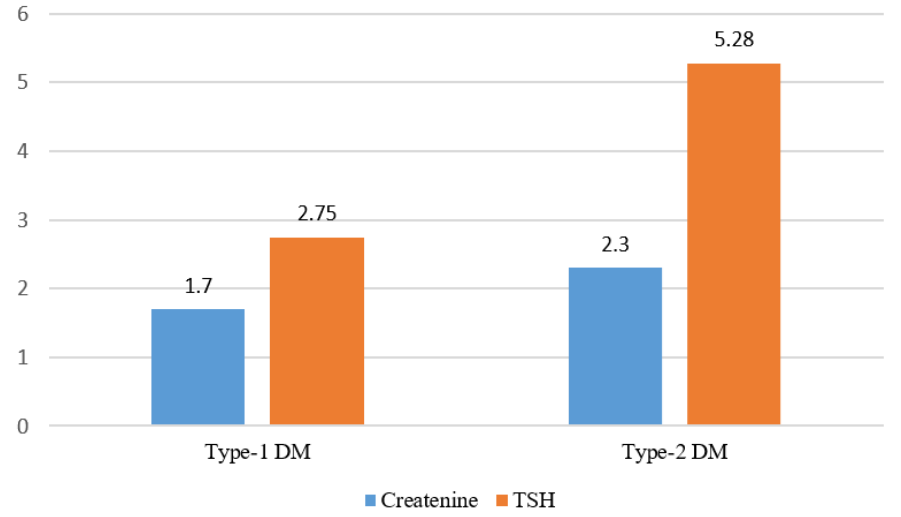

Figure 5: Comparison of creatinine & TSH parameters between type-1 and type-2 diabetic subjects

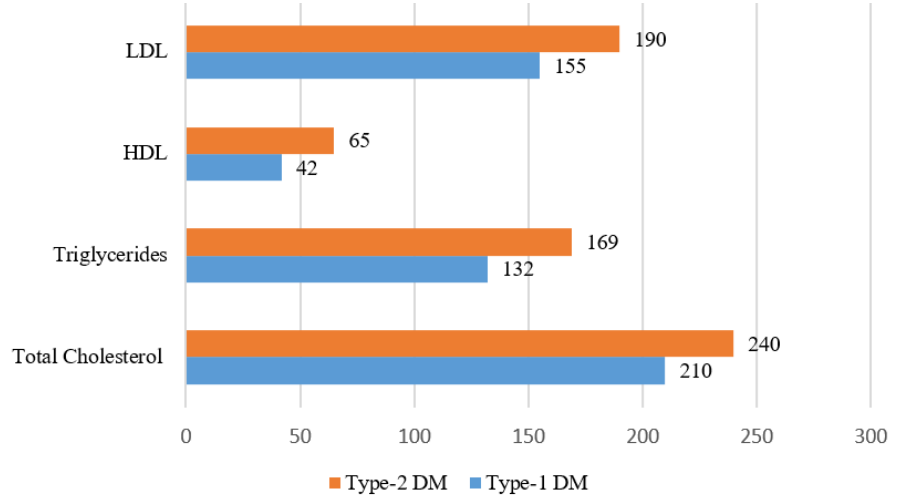

Figure 6: Comparison of lipid profile between type-1 and type-2 diabetic subjects

40-50 age group type-1 was 2 subjects and type-2 was 18 subjects; 50-60 age group type-2 was 30 subjects; 60-70 age group type-2 was 13 subjects; 70-80 age group type-2 was 7 subjects and 80-90 age group type-2 was 5 subjects.

Among 100 patients, 20% patients were Type-1 and 80% patients were Type-2 diabetic patients. In comparison between Type-1 and Type-2 diabetic patient showing that, Fasting plasma glucose is little bit higher in type-1

diabetic patient than type-2 diabetic patient. Creatinine range is lower in type-1 diabetic patient than in type-2 diabetic patient. HbA1c level is un type-2 diabetic patient than in type-1 diabetic patient. TSH level is significantly high in type-2 diabetic patient than in type-1 diabetic patient. Lipid profile is (TC, TG, HDL and LDL) high in type-2 diabetic patient than in type-1 diabetic patients.

DISCUSSION

Type-1 diabetes was previously called insulin dependent diabetes or juvenile onset diabetes. This is immune mediated diabetes. Type-1 diabetes mellitus results from an absolute deficiency of insulin due to autoimmune destruction of the insulin producing pancreatic beta cell (Khowaja *et al.* 2007). This type of diabetes can affect generally in early stage of life and insulin is required for survival. It has multiple genetic predispositions and has also been said to be related to environmental factors, though still poorly defined. This type of diabetes accounts for 5-10% of those with diabetes (Wang *et al* 2009). Type-2 diabetes mellitus is the commonest form of diabetes. It is also called non-insulin dependent diabetes mellitus or adult-onset diabetes. This type of diabetes is characterized by insulin resistance or abnormal insulin secretion (Krop *et al.* 1998). Type-2 diabetes mellitus is a disorder entirely separate from type-1 diabetes mellitus. Relative beta cell insufficiency is by definition, present in all individuals with type-2 diabetes mellitus (Chaikledkaew *et al.* 2008). In most cases, this disorder is also characterized by insulin resistance detected at the level of skeletal muscle, adipose tissue and the liver. Insulin resistance at the former site results in decreased peripheral glucose disposal, while the latter in increased hepatic glucose production. In many individuals, the natural history of type-2 diabetes mellitus begins with a period of insulin resistance with preserved, indeed augmented pancreatic insulin secretion as the insensitivity to insulin action in peripheral tissues is overcome by hyper-insulinemia (Vanderlee *et al.* 2016). As a result, plasma glucose level remains relatively normal. As the disease progress, however pancreatic islet cell function falters and it is no longer able to meet the peripheral demand. As a result, insulin levels fail to keep up with requirement and hyperglycemia ensues. Type-2 diabetes mellitus accounts for approximately 90-95% of those with diabetes (Welsh *et al.* 2010).

One study suggests that HbA1c has a relations with serum lipid profile, blood glucose level, serum creatinine and SGPT in diabetic patients (Roy *et al.* 2016). A significant correlation among HbA1c, FBG and PPG is in agreement with earlier reports. We also observed significant correlations between HbA1c and cholesterol, triglycerides, HDL and LDL in type 2 diabetic (Rosediani *et al.* 2006). Several investigators have reported significant correlations between HbA1c and lipid profiles and suggested the importance of glycemic control. It has also been reported that clinical significance of various lipid parameters including total cholesterol, triglycerides HDL and LDL in predisposing diabetic patients leads to cardiovascular complications (Islam *et al.* 2022).

The study was done to estimate the different clinical parameter states in 100 Diabetes Mellitus (DM) patients in which 20 patients were Type-1 and 80 patients were Type-2 DM affected. Among them were 62% male and 38% female patients. Observation made in several categories. According to age distribution chart, it was found that younger people are more affected by type-1 DM and on the other side, older people are more affected by type-2 DM. Fasting plasma Glucose (FPG) and 2 Hour ABF Plasma Glucose level are higher in type-1 DM subjects than type-2 DM subjects. Creatinine range is lower in type-1 DM than type-2 DM patient. Similarly, HbA1C, TSH level and lipid profile is increased in type-2 DM patient than type-1 DM subjects.

CONCLUSION

In recent years, Diabetes Mellitus (DM) has appeared to be a global health problem. It is one of the leading causes of death, disability, and economic loss. Diabetes affects persons of all ages and races. This disease reduces both a person's quality of life and life expectancy and imposes a large economic burden on the healthcare system and on families.

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