FREQUENCY OF PREDIABETES IN A COHORT OF INDIVIDUALS REPORTING TO COMBINED MILITARY HOSPITAL, QUETTA FOR EVALUATION OF SERUM GLUCOSE LEVELS

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ABSTRACT

Objective: To determine the frequency of prediabetes in a cohort of individuals reporting to Combined Military Hospital, Quetta and find association of prediabetes with gender and age.

Study Design: A descriptive cross-sectional study.

Place and Duration of Study: Combined Military Hospital Quetta, from Jan 2016 to Mar 2017.

Material and Methods: Through non-probability consecutive sampling, we included 200 individuals who reported to the pathology department for oral glucose tolerance test (OGTT). Two females with pregnancy were excluded owing to gestational changes in glucose metabolism. The blood samples from these individuals were taken after ten hours of fasting and two hours after loading with 75g of anhydrous glucose and analyzed using enzymatic method (Glucose Oxidase) on Vitalab Selectra E Clinical Chemistry Analyzer. The fasting plasma glucose (FPG) and plasma glucose levels two hours after glucose load, recommended by American Diabetic Association for prediabetes, diabetes mellitus (DM), and normal range were taken as the standards. The sample was divided into two groups based on age i.e. Group-I (age 10-44 years) and group-2 (age: 45-78 years) to check association of age with prediabetes.

Results: The sample (mean age: 32.7 ± 9.8 years) had a larger proportion (61.6%) of females and age-group of 10-44 years (88.9%). Eight (4%) individuals had DM, 58 (29.3%) had prediabetes, and 132 (66.7%) had a normal study. The prediabetes was significantly more common in males (p=0.001) and age-group of 45-78 years (p=0.006).

Conclusion: The prevalence of prediabetes and DM was 29.3% and 4% in our sample, which is quite high, comparable to earlier Pakistani data. Older age and male gender were significantly associated with prediabetes.

Keywords: Diabetes mellitus, Impaired fasting glucose, Impaired glucose tolerance, Prediabetes, Quetta.

INTRODUCTION

Diabetes mellitus (DM) can be found in every country. Some 382 million people worldwide, or 8.3% of adults, are estimated to have DM[1]. Prediabetes is a risk state that defines a high chance of developing diabetes. It includes impaired fasting glucose (IFG) and impaired glucose tolerance (IGT). Some 316 million people worldwide, or 6.9% of adults, are estimated to have prediabetes[1]. The vast majority (70%) of these people live in low and middle-income countries[1].

Prediabetes is typically defined as blood glucose levels above normal but below DM thresholds. According to the World Health Organization (WHO), high risk for developing DM is related to IFG and IGT[2]. The American Diabetes Association (ADA) defines prediabetes as a value of IFG between 5.6–6.9 mmol/L or IGT between 7.8-11 mmol/L[3]. People with prediabetes are at high risk of developing type 2 DM, although all people with prediabetes do not always go on to develop the disease[1]. Individual risk factors for diabetes (e.g. first degree relative with DM, history of gestational diabetes) or a combination of risk factors like metabolic syndrome can also be used to define populations at risk for developing diabetes but their predictive value is poorer than that of prediabetes[4]. According to an ADA expert panel, up to 70% of individuals with prediabetes may eventually progress to diabetes[5]. A recent study

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cited the average time for progression as less than three years[6].

Patients with DM are at increased risk of developing infections, cataract, glaucoma, retinopathy, nephropathy, neuropathy, ischemic heart disease, cerebral infarct, and gangrene[1,3]. In a recent Pakistani study, of the 678 type-2 DM patients, 0.56% were diagnosed with retinopathy, 0.84% with nephropathy, 0.28% with neuropathy, 28.17% with ischemic heart diseases, 8.45% with stroke, and 5.35% with peripheral vascular disease[7]. Prediabetes is also a risk factor for mortality[8]. In the above context, this study was aimed at detecting the individuals with prediabetes so that they might be educated about their future risks of developing diabetes. These individuals might then be advised to adopt healthy lifestyle and dietary modifications that would help reduce the future risk of complications. The association of prediabetes with gender and age were secondary goals.

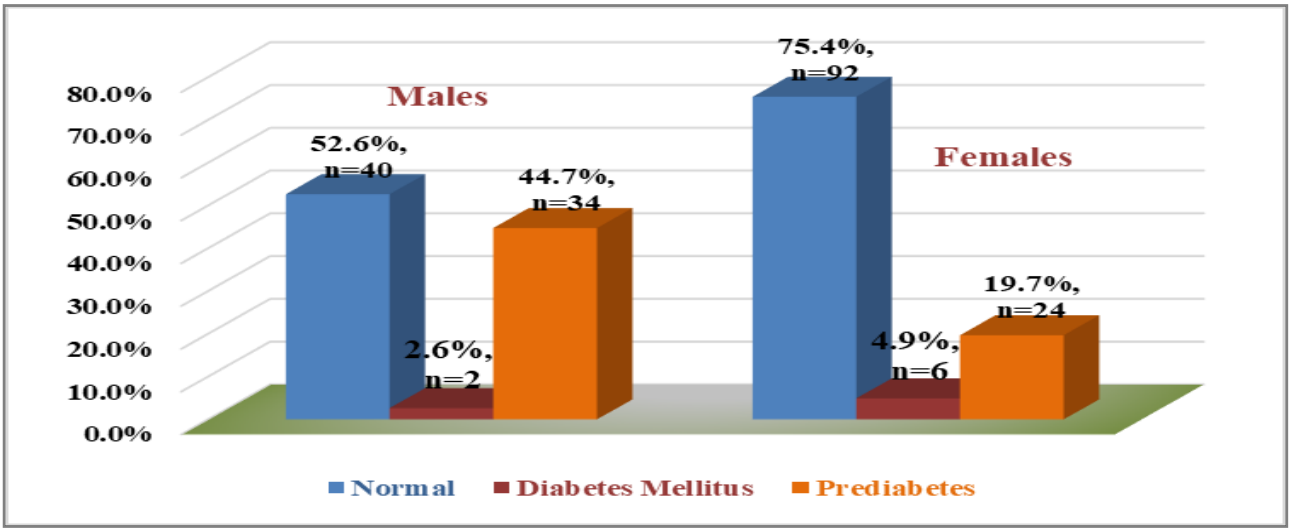

Figure-1: Percentage and frequencies of prediabetes and diabetes mellitus among different genders.

MATERIAL AND METHODS

This was a cross-sectional study conducted at the pathology department, Combined Military Hospital, Quetta from January 2016 to March 2017 after taking permission from the hospital ethical committee. A sample size of 99 was estimated via EpiTools Epidemiological Calculators[9], while keeping level of significance 5%, confidence level 95%, estimated true proportion 6.9%[1], and 5% of absolute precision. Through non-probability consecutive sampling, we included 200 individuals who reported to the pathology department for oral Glucose Tolerance Test (OGTT) during the said time period. Two females with pregnancy were excluded owing to gestational changes in glucose metabolism.

After verbal informed consent, the samples were taken from the sampled individuals through antecubital veins using aseptic technique after ten hours of fasting and two hours after loading with 75g of anhydrous glucose. The samples were taken in sodium fluoride tube, immediately centrifuged and analyzed using enzymatic method (Glucose Oxidase) on Vitalab Selectra E Clinical Chemistry Analyzer (Vital Scientific NV., Dieren, The Netherlands). The fasting plasma glucose and plasma glucose levels two hours after glucose load, recommended by ADA for prediabetes, DM, and normal range were taken as the standards. Any individual fulfilling any of the two criteria was considered to have DM or prediabetes. This is because the hyperglycemic states although can be detected by FPG measurements, IGT can detect the early development of diabetes when FPG may not be increased. Previous studies have revealed that

approximately 30% of individuals may have a normal FPG, whereas, their IGT suggests diabetes[10].

The data were analyzed using SPSS version 20. The sample was divided into two groups based on age i.e. group-1 (age 10-44 years) and group-2 (age: 45-78 years). The frequencies and percentages, means and standard deviations were calculated for categorical and numerical data respectively. The association of prediabetes with gender and age-group was analyzed using Pearson's Chi-square analysis. A *p*-value <0.05 was considered significant.

RESULTS

Out of 198 individuals (mean age: 32.7 ± 9.8 years, range: 10-78 years), 176 (88.9%) individuals were in age-group of 10-44 years and 22 (11.1%) individuals were in age-group of 45-78 years. Seventy-six (38.4%) of the sample were male and 122 (61.6%) were female. The mean FPG level was 7.8 ± 5.4 mmol/L (range 3.4-7.8 mmol/L) and the mean two hours post load levels were 6.5 ± 1.9 mmol/L (range 3.8-13.7 mmol/L). Eight (4%) individuals had DM, 58 (29.3%) had prediabetes, and 132 (66.7%) had a normal study. Of 58 individuals with prediabetes, 32 (55.2%) fulfilled the criteria of IFG and 26 (44.8%) fulfilled the criteria of IGT.

On evaluating association of prediabetes with age and gender, it was significantly more common in males (*p*=0.001) and age-group of 45-78 years (*p*=0.006). The distribution of individuals with DM, prediabetes, and normal values among gender and age-groups are presented in fig-1 & 2 respectively.

DISCUSSION

There has been quite variation in the incidence of prediabetes among different ethnic groups, cultures, and geographic distributions[1]. In our study, we found a prevalence of 29.3% for prediabetes, which is quite high than the international prevalence of 6.9%[1]. A review of trends and prevalence of diabetes epidemic in South Asia has found a prevalence of prediabetes ranging from 4.7-12.4% in Bangladesh, 4.1-15.5% in India, 3-10.2% in Pakistan, 11.5-14.1% in Sri Lanka, 11.5-19.5% in Nepal, and 3-6.5% in Maldives[11]. The other neighboring countries had a prevalence of 16.8% (Iran)[12] and 9.5% (China)[13]. A WHO report has mentioned prevalence of prediabetes to be 17.9% in Kuwait, 16.5% in Poland, 15.2% in Malaysia, 12.6 in Japan, and 12.4% in Singapore[1]. Another multiethnic study has found prevalence of prediabetes as 17.8% in the Southern Cone of Latin America, 9.8% and 17.1% in Peru, and 13.8% and 9.9% in South Africa[14]. The apparently high percentage of

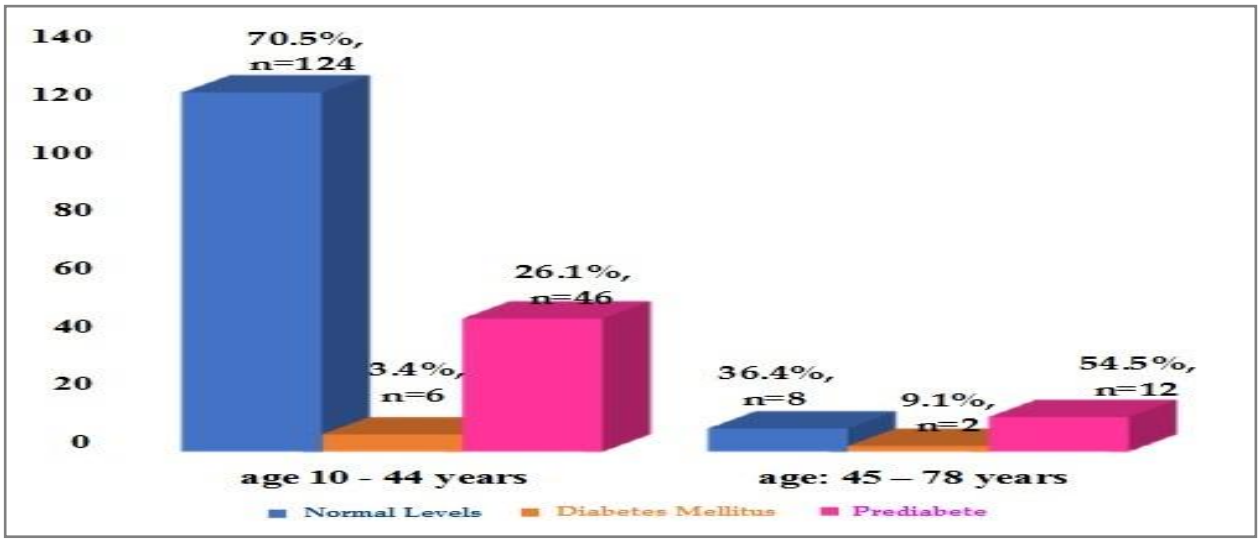

Figure-2: Percentage and frequencies of prediabetes and diabetes mellitus among different age groups.

prediabetes observed by us appears to be due to clustering of diabetic cases in our sample, because, we did not exclude individuals who were already diagnosed with prediabetes or DM.

In the literature, the gender does not seem to demonstrate a distinct association with prediabetes as increased risk shown by several studies has been contradicted by others[11]. In this study, we found a significantly higher incidence of prediabetes in men than women which is consistent with the data from the US, where male gender was associated with increased prevalence of IFG[15]. On the contrary, Shera and colleagues, in four epidemiological studies carried out in Punjab[16] Baluchistan[17], Sindh18, and all over Pakistan[19] found a significantly higher percentage of women with prediabetes than men and attributed this high prevalence to increased waist to hip ratio observed in females of studied population. A recent Indian study has also pointed out a higher prevalence of prediabetes and DM among the females[20]. Similar trend was observed by International Diabetes Foundation while pooling up data from all over the world[1]. However, a study carried out by *Shera et al* in Khyber Pakhtunkhwa observed no such association[21]. Another Pakistani study by Akhter and Colleagues discovered no statistically significant association between diabetes and gender (p=0.06)[22]. Similarly, according to a Chinese study, the age-standardized prevalence of prediabetes did not differ significantly among the two sexes (p=0.08)[13].

Advancing age has been identified as the major risk factor for development of prediabetes and DM in nearly all Pakistani studies[16-19,21,22]. Similar findings were reported by two Indian studies[20,23]. Increased prevalence of DM and prediabetes with age in both genders is consistent with findings of a meta-analysis of many South Asian studies. Older adults are at high risk for the development of type 2 diabetes due to the combined effects of increasing insulin resistance and impaired pancreatic islet function with aging[24]. Age-related insulin resistance appears to be primarily associated with adiposity, sarcopenia, and physical inactivity[25].

This study had few limitations. It was a small-sample and single-center study with shortcomings in the exclusion criteria, thus the results cannot be assumed for the whole population of Baluchistan. In addition, no information was collected on physical activity levels, body mass index, tobacco use or dietary habits, which have all been associated with prediabetes and DM in other studies.

CONCLUSION

The prevalence of prediabetes and DM had been 29.3% and 4% in our sample, which is quite high, comparable to data already on paper from Pakistan. Older age and male gender were significantly associated with the prediabetes. With appropriate measures to control prediabetes, the development of frank diabetes and worse outcome may be prevented.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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