Proceedings of Jaffna University International Research Conference (JUICE-2012), pp. 110-115, published: March 2014, Sri Lanka

Preliminary Study on Prevalence of Diabetes Mellitus and Metabolic Syndrome in Adults in Point Pedro and Karaveddy

S. Amarasinghe†, S. Balakumar and V. Arasaratnam
Department of Biochemistry, Faculty of Medicine, University of Jaffna, Sri Lanka
†rathypera@yahoo.com

Abstract: The aim of this preliminary study was to assess the prevalence of diabetes mellitus and metabolic syndrome among adults aged above 20 years in Point Pedro and Karaveddy MOH area of Jaffna district. This was a cross sectional community based descriptive study and it was carried out during the year 2011. A total of 115 subjects were included in this study using multistage random sampling. Forty eight percentage (56 Nos) of the sample was males. The prevalence of diabetes mellitus for adults aged ≥ 20 years was 15.7% and it was 12.5% among males and 18.6% among females. Of the total population 8.7% had impaired fasting glucose level, and it was 7.1 and 10.2% among males and females respectively. Of the diabetic subjects 33% were previously undiagnosed. Overall, 24.4% had some form of dysglycaemia, and it was 19.6% among males and 28.8% among females. There was a linear relationship between the categories of age and percentages of diabetes (R^2=0.987, p=0.0001). The subjects in the categories of 70-79 and 60-69 years showed high percentages of diabetes (33.3 and 26.9% respectively). Obese persons showed the highest prevalence of diabetes (33.3%) than overweight (13.3%) and normal individuals (15.5%). Metabolic syndrome was present in 14 (12.2%) out of 115 subjects. The prevalence of metabolic syndrome in females (20.3%) was higher than in males (3.6%). The subjects in the age categories of 40-49, 50-59 and 60-69 years showed high prevalence of metabolic syndrome (21.4, 35.7 and 28.6% respectively). Prevalence of central obesity was 36.5% in general population and was higher in females (61%) than in males (10.7%). Hypertension was high in the diabetics (61.1%) than in general population (20.9%). Of the total population 79.1% had dyslipidaemia, and it was 83.3% among the diabetics. Decreased HDL level was observed in dyslipidaemia. About 17.4 % of general population had both hypertension and dyslipidaemia while it was observed in 44.4% of diabetics. Prevalence of diabetes mellitus and metabolic syndrome are high in this community. High numbers of people have dyslipidaemia due to low level of HDL cholesterol.

Keywords: Body mass index, Diabetes, Metabolic syndrome, Prediabetes, Waist circumference.

I. Background And Objective

Diabetes mellitus (DM) develops when the pancreas does not make enough insulin, or the cells in the muscles, liver, and fat show resistance to insulin, or both. As a result, the amount of glucose in the blood increases while the cells are starved of energy.

Diabetes is a non-communicable disease which is increasing in pandemic proportions and has a national level health impact in developing countries such as Sri Lanka. Since there is no cure for the disease and many who develop the disease are unaware of the condition, it is important for early identification to take control measures for those who have already developed the disease and to adhere preventive measures for those who have higher risk of developing the disease. Identifying asymptomatic persons in the early stage of the disease process allow early institution of lifestyle changes and medical therapy that may decrease the complications of hyperglycemia.

Metabolic Syndrome is a combination of medical disorders that increase the risk of developing cardiovascular disease (CVD) and diabetes such as raised fasting plasma glucose, abdominal obesity, high cholesterol and high blood pressure. Identifying people with metabolic syndrome helps to prevent the increasing morbidity and mortality due to Type 2 DM and CVD in this region.

The prevalence of diabetes varies from place to place, even within a country it differs in different geographical areas. Local studies show a definite upward trend in the prevalence of diabetes. Sri Lanka is among the countries with the highest diabetes prevalence rates in the world. According to the estimates, there should be 2.8 million adults with diabetes in Sri Lanka at present and a significant proportion of this may yet to be diagnosed [4].

This type of screening programmes has not been reported from Jaffna District. Also findings of the many studies done in other districts cannot be simply extrapolated to the Jaffna peninsula which inhabits a different ethnicity having an entirely different socio-economic and cultural practice.

II. METHODOLOGY

2.1. Study area, study population, and sampling technique

This was a community based cross sectional descriptive study and it was carried out during the year 2011. Individuals from Point Pedro and Karaveddy MOH area of Jaffna district were selected for this study.

Persons above 20 years of age and residing in these areas were included. Pregnant ladies, institutionalized persons (prison, hospital, hostel, religious institutions), and persons with abdominal lumps, systemic illness, acute illness were excluded for sampling. Calculated sample size was 320. In this study, it was smaller due to fund limitation.

A multi-stage random sampling was used to obtain a representative sample from this population. At first, four Grama Niladari (GN) divisions were selected randomly from each MOH area. Then, 15 subjects were selected randomly from each GN area.

Ethical clearance was obtained from the Ethical Review Committee, Faculty of Medicine, University of Jaffna. All precautions were taken to ensure confidentiality of the data. Written consent was obtained from each participant.

2.2. Study Instruments

Questionnaire: Interviewer administered questionnaire which contains individual information and some needed medical information was used. It includes data gathering form for recording anthropometric measurements, and biochemical findings. Field investigators were pre intern doctors. The main tasks of pre intern trained doctors were to identify and recruit eligible persons, to administer the questionnaire and to carryout anthropometric measurements and blood pressure.

Anthropometric measurements: Anthropometric estimations were made for all subjects who were included in this study. Body weight, height, waist circumferences, and hip circumferences were taken using standard methods [8]. Body weight was measured with light cloths without shoes to the nearest 100g using an electronic digital weighing scale (SEGA weighing balance). Height was

measured using a stadiometer (SEGA stadiometer) without shoes and recorded to the nearest 10th of a centimeter with the subject looking straight ahead. Waist circumference was taken by positioning the non elastic measuring tape midway between the lower rib margin and the iliac crest, at the end of a normal expiration to the nearest 0.5 centrimeter. Hip circumference was taken with non elastic measuring tape as maximal circumstances at the buttocks, to the nearest 0.5 centrimeter. All measurements were taken when participants are in upright position, in light indoor clothing, without foot wear or heavy items in person. Blood pressure was measured in the seated position after the participants had rested for at least 5 minutes. The measurement was taken using the supported left arm at the heart level, using sphygmomanometer. Two recordings were taken and the mean was used for analysis. In the event of variation of over 20 mmHg between recordings, a third reading was done and the mean of the last two recordings was used [8].

Biochemical analysis: To standardize the fasting plasma glucose (FPG) measures, subjects were requested to attend the survey early in the morning after an overnight fast of 12 hours. Already diagnosed diabetic subjects were requested to participate without the morning dose of oral medications or insulin. Blood samples were withdrawn and analysed for FPG, high density lipoprotein, and triglycerides using enzymatic colorimetry (Teco Diagnostics 3300 Semi-automatic analyser).

2.3. Diagnostic criteria

Diagnostic criteria for DM: In DM, FPG is ≥ 126 mg/dl. In impaired glucose homeostasis, it ranges from 110 to <126 mg/dl. In normal, FPG is <110 mg/dl [7].

Diagnostic criteria for metabolic syndrome: According to the new IDF definition, for a person to be defined as having the metabolic syndrome they must have central obesity (defined as waist circumference* with ethnicity specific values) plus any two of the following four factors given in Table 1 [6].

Central obesity for South Asians is considered as the waist circumference ≥ 90 cm for males and ≥ 80 cm for females [6].

Table 1: Diagnostic criteria for metabolic syndrome

Biochemical parameters	**Diagnostic criteria for metabolic syndrome**
Raised triglycerides	≥ 150 mg/dl or specific treatment for this lipid abnormality
Reduced HDL cholesterol	< 40 mg/dl in males, < 50 mg/dl in females, or specific treatment for this lipid abnormality
Raised blood pressure	systolic BP ≥ 130 or diastolic BP ≥ 85 mm Hg or treatment of previously diagnosed hypertension
Raised FPG	FPG ≥ 100 mg/dL, or previously diagnosed type 2 diabetes

2.4. Statistical analysis

Statistical analysis was done using the SPSS Version 16 statistical package. The probability level is set as $p<0.05$.

III. Results and Discussion

Hundred and twenty adults above 20 years of age were selected for this study. Hundred and fifteen were responded. Forty eight percentages (56 Nos) of the samples were males. The prevalence (95% confidence interval) of DM for adults aged>20 years was 15.7 % (±11.8) and it was 12.5 (±11.5) and 18.6% (±12.3) among males and females respectively. Difference in the prevalence of DM between males and females was calculated using Chi-square test. It was not significant (p=0.36). Of the total population 8.7% had impaired fasting glucose level, and it was 7.1 and 10.2% among males and females respectively.

Of the diabetic subjects 33% were previously undiagnosed. Overall, 24.4% had some form of dysglycaemia, and it was 19.6% among males and 28.8% among females. There was a linear relationship between the categories of age and percentages of DM (R^2=0.987, p=0.0001). The subjects in the age group of 70-79 and 60-69 years showed high percentages of diabetes (33.3 and 26.9% respectively). DM was more common among obese (33.3%) than overweight (13.3%) and normal individuals (15.5%).

The prevalence (95% CI) of MS of overall, males and females were 12.2, 3.5, and 20% respectively. Difference in prevalence of MS between males and females was calculated using Fisher's exact test. It was significant (p=0.009). The subjects in the age categories of 40-49 and 50-59 and 60-69 years showed higher proportion of MS (21.4, 35.7 and 28.6% respectively). Proportion of central obesity was 36.5% in general population and was higher in females (61%) than in males (10.7%). Hypertension was high in the diabetics (61.1%) than in general population (20.9%). Of the total population 79.1% had dyslipidaemia, and it was 83.3% among the diabetics. Decreased HDL level was observed in dyslipidaemia. About 17.4% of general population had both hypertension and dyslipidaemia while it was observed in 44.4% of diabetics.

Katulanda *et al.*, [5] reported that in a National study, the highest prevalence was 18.6% from the Western Province and the lowest was 6.8% from the Uva Province. In this study, the prevalence of DM (15.7 %) was next to Western Province [5].

In this study, prevalence of DM was higher in females (18.6%) than in males (12.5%). It is comparable with the observation of Katulanda *et al.*, [4] (where the prevalence was 10.9% in females and 9.8 % in males). While Wijewardena *et al.*, [8] (14.2% in males, and 13.5% in females) have observed that prevalence of DM was higher in males than in females. This is controversial finding to this study. This could be due to the difference in the ethnicity as food and life style culture of the population selected for this study. Of the diabetic subjects 33% were previously undiagnosed. More number of subjects was undiagnosed due to asymptomatic early stage of disease process of diabetics. Therefore a study to identify pre-diabetes patients would be beneficial.

Of the total population 8.7% had impaired glucose tolerance (IGT), and it was 7.1 and 10.2% among males and females respectively. These results were in between the results reported by Fernando *et al.*, [3] (5.02%) and Katulanda *et al.*, [4] (11.5%) for suburban and urban-rural mixed areas of Sri Lanka.

Overall, 24.4% had some form of dysglycaemia (DM and IGT). This observation is comparable with that observed by Katulanda *et* al (2008, 21.8%). Dysglycaemia was higher in females (28.8%) than in males (19.6%) in this study.

There was a linear relationship between the age and percentages of diabetics (R^2=0.987). Among the subjects those in the age group of 70-79 and 60-69 years showed high percentages of diabetes (33.3 and 26.9% respectively). With an increase in age, the percentage of persons affected with diabetes also increased. Thus, getting older might be one of risk factors for developing Type 2 diabetes.

The selected subjects were classified as underweight (BMI<18.5), normal weight (BMI=18.5-24.99), over weight (BMI =25-29.99) and obese (BMI =30-40) based on WHO classification of Body Mass Index for Asians (2006). Obese persons showed highest prevalence of diabetes (33.3%) than overweight (13.3%) and normal persons (15.5%).

Central obesity or high waist circumference (male≥90 cm, female≥80 cm) was more common among diabetics (38.9%) when compared with non-diabetics (26.8%). Similar observation was made by Fernando *et al*., [3] (21 and 10.5%).

Among the 115 subjects, 14 (12.2%) had metabolic syndrome. The prevalence of metabolic syndrome in females (20.3%) was higher than in males (3.6%). A higher prevalence in women might be related to their higher rates of central obesity. These values were lower than that reported by Chakkarawarthy *et al*., [1] (45.8% in females and 23% in males). The prevalence of metabolic syndrome in our study among the female was 6 times higher than that in males, and this was similar to that reported by Chackrewarthy *et al*., [1] in Sri Lanka where they have observed that the prevalence in females was 2 times higher than that in males.

High prevalence of metabolic syndrome was observed among the subjects those who are in the age groups of 40-49, 50-59 and 60-69 years (21.4, 35.7 and 28.6%, respectively).

In this study, prevalence of central obesity was 36.5% in general population, and it was higher in females (61%) than in males (10.7%). It is comparable with the study carried out by Wijewardena *et al*., [8] where the prevalence of central obesity was higher in females (36.5%) than males (20.3%).

In this study, prevalence of hypertension was 21.4% in males and 20.3% in females. It was comparable with the study of Wijewardena *et al*., [8] (18.8% in males and 19.3% in females). Prevalence of hypertension was high in diabetics (61.1%) than in normal population (20.9%). Dyslipidaemia (elevated triglycerides and/or low HDL cholesterol) was observed in 79.1% of the all subjects and was 83.3% among the diabetics. This might have occurred mainly due to low HDL level. Similar to our finding increased prevalence of low HDL level has been reported earlier by Enas *et al*., [2]. About 17.4 % of general population had both hypertension and dyslipidaemia while diabetics had 44.4%. Based on a high prevalence of diabetes, hypertension and central obesity, it may be postulated that insulin resistance exists in a significant proportion of the population. The factors responsible for such high rates of risk factors should be further explored and monitored in the future.

IV. Conclusion

Based on this research finding, prevalence of diabetes mellitus and metabolic syndrome are high in this community. A study including high number of participants is needed for further conclusions.

Acknowledgment

Authors wish to thank for funding by Medical Faculty development fund.

References

[1]. Chackrewarthy, S, Gunasekera, D., de Silva, L.D.R., Pathmeswaren, A., Wijekoon, C.N., Ranawaka, UK., Mizoue, T. and Kato, N., *"Prevalence of metabolic syndrome in a Sri Lankan community"* Ceylon medical journal, 2008.

[2]. Enas, E.A., Yusuf, S. and Mehta, JL., "Prevalence of coronary artery disease in Asian Indians," *American Journal of Cardiology*, Vol. 70, No. 9, pp. 945–949, 1992.

[3]. Fernando, D. J. S. Impaired Glucose Tolerance and Diabetes Mellitus in suburban Sri Lankan Community. Postgraduate Medical Journal, 70: 347-9, 1994.

[4]. Katulanda, P., Constantine, G. R. , Mahesh, J.G., Sheriff, J.G., Seneviratne, R.D.A., Wijeratne, S., Wijesuriya, M., Mc Carthy, M.I., Adler, A.I. and Matthews, D.R., "Prevalence and projections of diabetes and pre-diabetes in adults in Sri Lanka", Sri Lanka Diabetes, Cardiovascular Study (SLDCS), Original Article: Epidemiology, 2008.

[5]. Katulanda, P., Rathnapala, D.A.V., Sheriff, R. and Matthews, D.R, "*Province and ethnic specific prevalence of diabetes among Sri Lankan adults*", Sri Lanka Journal of Diabetes Endocrinology and Metabolism, 1:2-7, 2011.

[6]. The IDF consensus worldwide definition of the metabolic syndrome, 2006.

[7]. The World Health Report, Changing history, Genève: World Health Organization, 2006.

[8]. Wijewardene, K., Mohideen, M. R., Mendis, S., Fernando, D.S., Kulathilaka, T., Weerasekara, D., and Uluwitta. P., "Prevalence of hypertension, diabetes and obesity: baseline findings of a population based survey in four provinces in Sri Lanka", *Ceylon Medical Journal*, 2005.