Prevalence of Type 2 Diabetes and Prediabetes in Neyyattinkara Taluk of South Kerala

Regi Jose, a KK Manojan, b Paul Augustine, c Zinia T Nujum, d A Althaf, e Seena KM, f Ramdas Pisharady g

a. Department of Community Medicine, Sree Gokulam Medical College & Research Foundation, Thiruvananthapuram; b. Department of Internal Medicine, Sree Gokulam Medical College & Research Foundation, Thiruvananthapuram; c. Division of Surgical Oncology, Regional Cancer Centre, Thiruvananthapuram; d. Department of Community Medicine, Government Medical College, Thiruvananthapuram; e. Department of Community Medicine, Government Medical College, Manjeri; f. National Rural Health Mission, Kerala; g. Department of Nephrology, Government Medical College, Thiruvananthapuram

Corresponding Author: Regi Jose, Professor of Community Medicine, Sree Gokulam Medical College & Research Foundation, Venjaramoodu, Thiruvananthapuram, Kerala. Tel: +91 94464 75935, e-mail: regipauli@gmail.com

Abstract

Introduction: Type 2 Diabetes is a lifestyle related disease and a major risk factor for Cardio Vascular Diseases (CVDs). A very limited number of published studies indicate high prevalence of Type 2 Diabetes in the state of Kerala. This study was done in the Neyyattinkara taluk of south Kerala by including coastal, mid land and high land regions to make it representative of the geographical profile of the state.

Objectives: To estimate the prevalence of Type 2 Diabetes and Prediabetes among adults (aged 30 years and above) residing in Neyyattinkara taluk of South Kerala and to identify the diabetes Case Detection Rates across different age groups.


Results: Overall prevalence of Type 2 Diabetes was found to be 27.11% (95% CI 23 - 31.22) of which 18.44% were previously known cases and 8.67% were newly detected. Age standardized prevalence of Diabetes was 20%. Prevalence of Pre Diabetes was found to be 22.67% (95% CI 18.6 - 26.54). Diabetes Case Detection Rate was found to be 68%.

Conclusions: Prevalence of Type 2 Diabetes among adults was found to be very high in the study area in comparison to state, national and global figures. Also, high prevalence of Prediabetes points towards further increase in diabetes prevalence, requiring urgent public health interventions.

Keywords: Diabetes, Type 2 Diabetes, Prediabetes, Prevalence, Age Standardization, Kerala, South Kerala

Introduction

Whereas rest of India is still grappling with communicable diseases and malnourishment, the state of Kerala stands out, with non-communicable diseases (NCDs) emerging as a major public health challenge. This can be attributed mainly to improved living conditions and lifestyle changes in the state. Among the different lifestyle related diseases, Type 2 Diabetes mellitus is a major risk factor for Cardio Vascular Diseases (CVDs). Prevalence of risk factors for diabetes is also high in Kerala.1

As per the American Diabetes Association (ADA) Prediabetes is either Impaired Fasting Glucose (IFG) level = 6.1 to 6.9 mmol/L (110-125 mg/dL) and/or Impaired Glucose Tolerance (IGT) (2-hour post-load glucose of 7.8-11.0 mmol/L [140-199 mg/dL]). Fasting plasma glucose (FPG) is commonly used for diabetes screening. ADA lowered the fasting glucose threshold value for IFG from 110 to 100 mg/dL recently.2,3 Early detection of Prediabetes and appropriate lifestyle modification can prevent the development of full-fledged Diabetes mellitus. Only very few published studies are available on the prevalence of Diabetes in the state, most of which indicate high prevalence. The whole of Kerala has a unique geography in that the terrain changes from coastal areas on the western seaboard to high ranges in the east, with midlands in between. Neyyattinkara taluk cuts across this geographic pattern and provides a fairly representative sample of South Kerala. Estimates of prevalence help appropriate planning for interventions.

Objectives

- To estimate the prevalence of Type 2 Diabetes and Prediabetes among adults (aged 30 years and above) residing in Neyyattinkara taluk of South Kerala.
- To identify the diabetes Case Detection Rates across different age groups.
- To study the fasting plasma glucose levels as an indicator of diabetes control in the community.

*See End Note for complete author details
Materials and Methods

Study Design: Cross-sectional study.
Study Setting: 3 Panchayats of Neyyattinkara taluk.
Study Period: 9 Months (June 2009 - February 2010).
Study Subjects: Adults aged 30 years and above residing in study area. People who are seriously ill and those who do not give consent were excluded.
Sample Size: 450, calculated using the formula $n = \frac{(Z\alpha)^2 P(1-P)}{d^2}$ where, $P = 20\%$, $d$ is 4 (20% of $P$), and number required to study Diabetes is 384. Assuming 10% non-response $N = 422$ which was rounded to 450.

Sampling Technique: Multi-stage sampling (Figure 1). Two wards each were selected from 3 Panchayats coming under the three geographic regions. From each ward, 2 Asha Blocks were selected, from where the samples were taken.

Data Collection Tools: Structured questionnaire and Blood Sugar examination using Glucometer (DiabeCHECK- Jitron).

Data Collection: House to house visits.

Thiruvananthapuram district (4 taluks)

Neyyattinkara Taluk 26 Panchayats (450)

Coastal Area 8 panchayats

Kollathoor (150)

Kollamkodu Ward (75)

Kudappanamood Ward (75)

Kakkathukki Ward (75)

Koottapoo Ward (75)

Kuttamala Ward (75)

Mid Lands 12 Panchayats

Vellarada (150)

Beach Ward (75)

Kudappanamood Ward (75)

Kakkathukki Ward (75)

Koottapoo Ward (75)

Kuttamala Ward (75)

High Lands 6 Panchayats

Amboori (150)

Kollamkodu Ward (75)

Kudappanamood Ward (75)

Kakkathukki Ward (75)

Koottapoo Ward (75)

Kuttamala Ward (75)

Figure 1. Description of the Population and Sampling

Methodology

On visiting each panchayat, the local authorities were informed and two wards were selected randomly. Accredited Social Health Activists (ASHAs) (female health volunteers) from these wards were informed about the study. Consecutive Households were selected proportionate to the population of each ward. During the visits, after obtaining consent, the participants were interviewed using the pre-tested questionnaire. All the interviewed individuals were invited to a centrally located house next day morning for blood sugar estimation. They were instructed to come fasting. Blood glucose was estimated using a glucometer (DiabeCHECK Model: DC-300MS; Jitron Pvt. Ltd). Calibration was done daily to ensure reliability and new pairs of DC cells were used every day.

Diagnosis of Diabetes

Prevalence of Type 2 Diabetes was established using two diagnostic criteria; one for known cases of Diabetes and one for newly detected cases. Self-reported cases of Diabetes where the participants showed the actual diabetes medicines or a prescription for the medicine they were taking were classified as known cases of diabetes. Participants not knowing their diabetes status were diagnosed as diabetic if their fasting plasma glucose values were found to be greater than or equal to 126 mg% . Subjects with Fasting Plasma Glucose values between 110 mg% and < 126 mg% were classified as Prediabetic.

All newly detected diabetics were referred to local hospitals for further management. All Prediabetic were educated regarding lifestyle modifications for Diabetes prevention and motivated to follow up in local Primary Health Centres.

Data Analysis

Prevalence estimates were expressed as proportions with 95% confidence Intervals. Age standardized rates were calculated. Comparisons were made against state, national and global figures. Diabetes Case Detection Rate was calculated as a percentage of previously known diabetes out of total prevalence of diabetes.
Ethical Considerations

Ethical clearance was obtained from Institutional Ethical Committee, Trivandum Medical College. Participants were included in the study only after taking written informed consent. Reports of blood examination findings and anthropometric measurements were handed over to the participants as records. Participants were also provided additional free medical examination and counseling whenever necessary. No interventions, drugs or vaccines were tested in this study.

Results

Age of the participants ranged from 30 to 85 years with a mean of 49.99 years (SD-12.95). Figure 2 shows age distribution of the study participants. There were 184 (41%) males, and 266 (59%) females in the study sample.

Diabetes Case Detection Rates across different age groups were examined and was highest (76%) between 60 and 69 years. Lowest detection rate was in the age group 30-39 years (50%). Table 3 shows that Diabetes Case Detection rate improves with the age of the patient.

Prevalence of Pre diabetes was found to be higher in the younger age group, whereas Type 2 Diabetes was more among the older participants (Figure 3).

Overall prevalence of Type 2 Diabetes was found to be 27.11% (95% CI 23-31.22) of which 18.44% were previously known cases of diabetes and 8.67% were newly detected (Table 1). Age standardization was done to eliminate any bias during sampling. The age standardized prevalence of Diabetes based on the age distribution of Indian Population was 20.14% and based on age distribution of Kerala population was 19.59% (Table 2).

Fasting Plasma Glucose Levels

Examination of Fasting plasma glucose was done for all individuals and 18% had FPG > 125 mg% and 55.56% had < 100 mg%. (Figure 4) These include those who were previously diagnosed and already under treatment also. Figure 5 shows that 5.33% of the total participants had FBS < 100 mg%, 3.11% between 100 and110 mg%, 0.67% between 110 and 125 mg% and 9.33% had > 125 mg% were known diabetic under treatment (Table 4).

81 (18%) persons had blood sugar values above 125 mg%. Of these 42 were already diagnosed and was on treatment. 54 (12%) individuals had FBS value between 110 and 126 mg%. According to the Report of the AHA Expert Committee

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Total</th>
<th>Total Diabetics (Old &amp; New)</th>
<th>Prevalence % (95%CI)</th>
<th>Diabetics-Old</th>
<th>Prevalence % (95%CI)</th>
<th>Case Detection Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-49 yrs</td>
<td>111</td>
<td>31</td>
<td>25.41 (17.31-33.51)</td>
<td>19</td>
<td>22.89 (15.08-30.71)</td>
<td>61.3</td>
</tr>
<tr>
<td>50-59 yrs</td>
<td>98</td>
<td>37</td>
<td>30.33 (21.23-39.43)</td>
<td>28</td>
<td>33.73 (24.37-43.1)</td>
<td>75.7</td>
</tr>
<tr>
<td>60-69 yrs</td>
<td>78</td>
<td>25</td>
<td>20.49 (11.53-29.45)</td>
<td>19</td>
<td>22.89 (13.57-32.22)</td>
<td>76</td>
</tr>
<tr>
<td>70-79 yrs</td>
<td>35</td>
<td>9</td>
<td>7.38 (-1.28-16.04)</td>
<td>6</td>
<td>7.23 (-1.35-15.81)</td>
<td>66.7</td>
</tr>
<tr>
<td>&gt;=80 yrs</td>
<td>6</td>
<td>4</td>
<td>3.28 (-10.97-17.53)</td>
<td>3</td>
<td>3.61 (-11.32-18.55)</td>
<td>75</td>
</tr>
<tr>
<td>Total</td>
<td>450</td>
<td>122</td>
<td>27.11 (23.00-31.22)</td>
<td>83</td>
<td>18.44 (14.86-22.03)</td>
<td>68</td>
</tr>
</tbody>
</table>

on the Diagnosis and Classification of Diabetes Mellitus, a fasting plasma glucose of 110 to 125 mg/dL is now designated Impaired Fasting Glucose (IFG) 10% of these may progress to Diabetes. At this stage Diabetes may be prevented by lifestyle modifications.

Table 4. Fasting Blood Sugar Levels

<table>
<thead>
<tr>
<th>Fasting Plasma Glucose levels</th>
<th>Normal</th>
<th>Diabetes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100 mg/dl</td>
<td>226 (68.9%)</td>
<td>24 (19.7%)</td>
<td>250 (55.6%)</td>
</tr>
<tr>
<td>100-109 mg/dl</td>
<td>51 (15.5%)</td>
<td>14 (11.5%)</td>
<td>65 (14.4%)</td>
</tr>
<tr>
<td>110-125 mg/dl</td>
<td>51 (15.5%)</td>
<td>3 (2.5%)</td>
<td>54 (12.0%)</td>
</tr>
<tr>
<td>&gt;125 mg/dl</td>
<td>0 (0.0%)</td>
<td>81 (66.4%)</td>
<td>81 (18.0%)</td>
</tr>
<tr>
<td>Total (%)</td>
<td>328 (100.0%)</td>
<td>122 (100.0%)</td>
<td>450 (100.0%)</td>
</tr>
</tbody>
</table>

**Discussion**

**Prevalence of Diabetes and Prediabetes**

This study was conducted to find out the prevalence of Type 2 Diabetes and Prediabetes among adults aged greater than or equal to 30 years. This age group was selected because it is the target age group for NCD Control Programme of NRHM which was piloted in Neyyattinkara taluk of Thiruvananthapuram district. This study was conducted prior to the state wide implementation of the programme as this could help in planning logistics. The prevalence of previously known Type 2 Diabetes was 18.44% and newly diagnosed Diabetes was 8.67% amounting to a total prevalence of 27.11%. Age standardized prevalence was 20%. Prevalence and age standardized prevalence of Prediabetes was 22.67% and 22% respectively.

Results of a qualitative study for evaluation of NCD programme of NRHM conducted in the same area also indicates high prevalence of Diabetes and stresses the need for early detection through screening. In an earlier study done in 1999, prevalence of Diabetes among adults above the age of 20 years living in urban Trivandrum was 16.3% and age standardized prevalence was 13.7%. The apparent increase in prevalence found in the present study could be attributed to a higher age denominator and an actual increase in prevalence over a period of 10 years. This further emphasizes the need to prevent the conversion of Prediabetes in to Diabetes.

Another study conducted in central Kerala in 2007 with similar diagnostic criteria as the present study revealed overall and age standardized Diabetes prevalence of 14.6 percent and 12.5 percent respectively. This indicates a lower prevalence in central Kerala. A study from urban Chandigarh showed that 15.7% were diabetics and 15.4% were Prediabetics. The age-standardized prevalence of Diabetes and Prediabetes were 11.1% and 13.2% respectively. A national study to determine the prevalence of Diabetes and Prediabetes in India done in three states (Tamil Nadu, Maharashtra and Jharkhand) and one union territory (Chandigarh) showed that the weighted prevalence of Diabetes
was 10.4% in Tamil Nadu, 8.4% in Maharashtra, 5.3% in Jharkhand and 13.6% in Chandigarh. The prevalence of Pre diabetes in the same areas was 8.3%, 12.8%, 8.1% and 14.6% respectively. Many studies from different parts of the world had discussed the importance of diagnosing Prediabetes and importance of life style modifications.  

Studies from Kerala also emphasized the need for life style modifications and community based programmes for early detection and preventive measures. Diabetes Case Detection Rate in the present study was 50% in persons less than 50 years of age and more than 75% above the age of 50 years. This emphasizes the need for younger individuals to get early diagnosis and appropriate treatment. Prediabetes is also higher among younger age (Figure 3) with a gradual shift to Diabetes as age advances. These findings highlight the need for implementing diabetes screening programmes throughout the state. Several studies have demonstrated the use of Diabetes risk scores for this.

**Fasting Plasma Glucose:** Current study shows that 18% of the study participants had FPG > 125 mg% irrespective of their detection status. Of these nearly 50% were diagnosed old diabetic under treatment (Figure 5). Among the diabetics; 66.4% had FPG > 125 mg%. 19.7% of the diabetics had FPG < 100 mg% (Table 4). FPG can be used as an indicator for diabetic control status in the community.

Prevalence of Prediabetes (FPG 100-125 mg%) is found to be 22.67%. A study conducted to determine the utility of FPG alone for detecting Prediabetes in African Americans showed that FPG testing alone may be inadequate for diagnosing Prediabetes. Until alternative strategies are identified, an OGTT is presently the best method for detecting the Prediabetic condition in these high-risk patients.  

Prediabetes is a significant risk factor for the development of type 2 diabetes, micro vascular, and macro vascular disease. It represents an intermediate category along the continuum from normal glucose levels to overt hyperglycemia. The progression from Prediabetes to type 2 diabetes occurs over many years. Large, randomized prospective studies with lifestyle intervention and/or different modes of pharmacotherapy could demonstrate successful delay of diabetes.

**Conclusion**

The present study has found a high prevalence of Type 2 Diabetes mellitus among adults above the age of 30 years in a representative population of South Kerala. High proportion of Prediabetes among adults will further increase the prevalence of DM in the next few years. Early diagnosis of Prediabetes and Diabetes is important in the prevention of Diabetes related cardiovascular complications.

**End Note**

**Author Details**

1. Dr. Regi Jose, Professor of Community Medicine, Sree Gokulam Medical College & Research Foundation, Venjaramoodu, Thiruvananthapuram  
2. Dr. K. K. Manojan, Associate Professor of Medicine, Sree Gokulam Medical College & Research Foundation, Venjaramoodu, Thiruvananthapuram  
3. Dr. Paul Augustine, Additional Professor Div. Surgical Oncology, Regional Cancer Centre, Thiruvananthapuram  
4. Dr. Zinia T. Nujum, Associate Professor of Community Medicine, Government Medical College, Thiruvananthapuram  
5. Dr. A. Althaf, Associate Professor of Community Medicine, Government Medical College, Manjeri  
7. Dr. Jeessa C. Haran, Professor of Community Medicine, Sree Gokulam Medical College & Research Foundation, Venjaramoodu, Thiruvananthapuram  
8. Dr. Ramdas Pisharady, Principal, Professor Nephrology, Government Medical College, Thiruvananthapuram

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**List of Abbreviations**

- **IFG** - Impaired Fasting Glucose  
- **FBS** - Fasting Blood Sugar  
- **NCD** - Non Communicable Diseases  
- **CVD** - Cardiovascular diseases  
- **CI** - Confidence Interval

**Conflicts of Interest**

None declared

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References


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