

# Community-based Strategy for Prevention of Diabetes in Indians

## INTRODUCTION

Epidemiologic studies have provided overwhelming evidence that the prevalence of diabetes, particularly type 2 diabetes, is increasing rapidly in many nations<sup>1</sup> and that has become an public health problem throughout the world. Recently Wild et al<sup>2</sup> have projected that the global prevalence of type 2 diabetes will rise from 171 million in the year 2000 to 366 million by the year 2030. As a consequence of increasing urbanisation and associated lifestyle changes, this increase will be greatest in the developing world.<sup>3</sup> Asians and Hispanics have shown the higher prevalence of diabetes as compared to those of European descent (Caucasians) even when exposed to similar environmental conditions.<sup>4</sup> India has the highest prevalence of diabetes in the world (32 million and this is expected to increase to 80 million by 2030),<sup>2</sup> accounting for almost one-sixth of the world's diabetic individuals. Demographic and epidemiological evidence indicates that unless an effective preventive strategy is developed, there will be a sharp increase in the global prevalence of diabetes. There are and will be more people with diabetes, requiring ongoing, preventive, and corrective management, even if existing health care systems are improved and made maximally efficient and effective.<sup>5</sup> The focus of this chapter will be on the community-based strategies for prevention of diabetes.

## RISING COSTS OF DIABETES

Diabetes imparts enormous personal and public health burden worldwide.<sup>3</sup> The majority of health care costs for diabetes are spent in developed countries, whereas majority of disability-adjusted life years (DALYs) are lost in developing countries, where limited health care budgets are available.<sup>6</sup> Health resources in India and other developing countries are very limited with only 5% of Gross Domestic Product (GDP), being spent on health care.<sup>7</sup> The per capita expenditure on health care in India is only 6.4% of the average world spending, while India accounts for 23.5% of the world's disability-adjusted life years lost due to diabetes (DALYs).<sup>8</sup> In the developing

countries diabetes occurs at a younger age compared to developed countries, where it most commonly occurs in individuals aged 65 and above. In developing countries long-term complications of diabetes also occur in a large proportion of diabetic subjects during the most productive years of their lives, causing severe economic and social burden. It has thus become a great economic challenge as it drains between 5 and 25 % of the family income of an average Indian.<sup>9</sup> The indirect, social and personal costs are incalculable. Unless effective prevention strategies are put into place, the incidence of diabetes will continue to rise adding to the already strained health budgets of the nations.

### **AWARENESS OF DIABETES**

A large cross-sectional community-based survey called the Chennai Urban Rural Epidemiology Study (CURES),<sup>10</sup> carried out by us in Chennai, south India, showed that the awareness of diabetes is very low. Nearly 25% of Chennai residents were not even aware of a condition called diabetes and knowledge about complications of diabetes was even worse. Moreover, even among self-reported diabetics, knowledge and awareness about diabetes and its complications was poor and less than 50% only knew that the disease is preventable.

### **MODIFIABLE RISK FACTORS—LIFESTYLE FACTORS**

As urbanisation and economic growth occurs, there are significant changes in the diet and activity patterns of the community which are the important elements in the epidemiological transition heading to non-communicable disease like diabetes.

#### **DIETARY FACTORS**

Economic development with a global nutrition transition, characterised by declining dietary intakes of grains, fibres, fruits and vegetables, and rising consumption processed food, which contains more food of animal origin, animal proteins, more fat, sugar, sodium and often more alcohol, is occurring at accelerated rates throughout the developing world<sup>11</sup> with a shift from labour-intensive to less strenuous and stressful occupations with Western influences<sup>12</sup> which leads to alterations in eating preferences due to shifts in income, prices, advertising and exposure to mass media.<sup>13</sup> Appropriate strategies to reduce diabetes risk include improving the nutrition of young children, promoting linear growth and limiting intake of energy-dense foods, controlling the quality of fat supply, and facilitating physical activity.

#### **PHYSICAL ACTIVITY**

The world is today facing one serious problem that is people no longer need to be physically active in their daily lives.<sup>14-17</sup> To make matters worse, physical activity in childhood and adolescence appears to be on the decline.<sup>18</sup> Numerous studies have consistently shown that higher levels of

physical activity are associated with decreased risks of coronary heart disease, hypertension, diabetes and osteoporosis. Regular physical activity is associated with enhanced health and reduced risk of all-cause mortality.<sup>19-22</sup> Morris and colleagues showed more than 50 years ago that sedentary adults derive benefit from even slight exertion.<sup>23-25</sup> In a study conducted in south India, the risk of developing diabetes in the subjects who followed a sedentary lifestyle was three times higher compared to the more physically active subjects.<sup>26</sup>

Exercise has many benefits and many studies have shown that regular physical activity improves quality of life from psychological to physical with weight stability and reduces the risk of mortality from all causes,<sup>14-17</sup> and is particularly advantageous in subjects with impaired glucose tolerance<sup>27,28</sup> or diabetes.<sup>29-33</sup> The American Diabetes Association emphasises the benefits of regular physical activity in the prevention and treatment of type 2 diabetes<sup>14-17, 34</sup> and advise individuals to engage in  $\geq 30$  min moderate intensity physical activity on preferably all days of the week.

Physical activity is an effective cost-saving tool in the care of diabetes.<sup>31</sup> Brisk walking is the most common form of leisure time physical activity<sup>31</sup> practiced by diabetic subjects and most acceptable form of physical activity<sup>35,36</sup> to people with diabetes. The several studies strongly support that people at increased risk for developing diabetes should be encouraged to maintain a high level of physical activity in their lives.<sup>37</sup> Public health professionals worldwide should emphasise the need to increase activity levels during leisure time and to incorporate physical exercise into the daily routine in the treatment and prevention of diabetes.

## **OBESITY**

Epidemic of obesity is the most important factor in the subsequent rise of incidence and prevalence of diabetes. Eastern and subcontinental Asia with rising industrialisation and adoption of Western lifestyle habits clearly predisposing these populations to weight gain and other metabolic abnormalities.<sup>38</sup> Studies that aim to reduce obesity or prevent it from developing are relevant to the prevention of diabetes, since obesity is one of the major modifiable risk factors for diabetes. The International Obesity Task Force estimates that at present at least 1.1 billion adults are overweight, including 312 million who are obese. With the new Asian BMI criteria of overweight at a lower cut-off of 23 kg/m<sup>2</sup>, the number is even higher (1.7 billion people).<sup>39</sup> Rapid increase in the prevalence of obesity in the last decade and rising prevalence of overweight and obesity among children makes the situation more alarming.<sup>40</sup> Moreover, among countries in Asia, the prevalence rises concomitant with the country's level of socioeconomic transition. The prevalence is generally higher in urban areas than in the rural areas,<sup>40</sup> and in higher socioeconomic groups of the population.<sup>40, 41</sup> Many misconceptions were prevailing among the community and more worrisome was the fact that only 12% of the population was aware that obesity and physical inactivity could predispose to diabetes.<sup>10</sup>

In order to decrease the prevalence of obesity, a multifaceted public health approach is required to address the many behavioural, sociocultural and environmental factors in correcting caloric

intake and promoting physical activity among Indians<sup>42</sup> where daily physical activity decreased due to several reasons like increased reliance on motor vehicles, shift to more sedentary occupations, and the proliferation of television and computer technology which encourages more hours of sitting rather than standing or walking.

### **URGENT NEED FOR PREVENTION STUDIES**

Diabetes has rapidly become a global health problem with rapid worldwide increasing<sup>3,43</sup> population growth, aging, urbanisation, and increasing prevalence of obesity and physical inactivity<sup>2,44</sup> indicating the increasing need to prevent diabetes, rather than simply treat it, once established. Several studies of community-based NCD prevention projects attempted to prevent the onset of diabetes through lifestyle modification, reduction in obesity or through pharmacological means and clearly demonstrated risk factors reduction by healthy lifestyles bring a huge benefit to the public. However, the evidence on feasibility and effectiveness of applying such interventions in the developing world is still missing.<sup>45</sup> The importance of promoting physical activity a vital component of prevention and management of NCD's must be viewed as a high priority. This is particularly significant in developing countries like India as they are facing epidemiological transition coupled with lifestyle changes, which has resulted in massive increase in prevalence of diabetes and coronary artery disease.<sup>2, 46-51</sup>

### **PREVENTION OF DIABETES**

#### **STAGES IN THE NATURAL HISTORY OF DIABETES**

The various periods of opportunity for the prevention and the consequences of diabetes with number of modifiable risk factors are illustrated in Figure 26.1. Diabetes usually progresses from impaired glucose tolerance (IGT) or pre-diabetes stage to an early asymptotic stage to onset of clinical diabetes and then to the stage of complications. The three points in the natural history of the disease where prevention is possible are depicted in Figure 26.1.

#### **PRIMARY PREVENTION**

Prevention of the emergence or development of risk factors in population groups in which they not yet appeared by taking action prior to the onset of disease, which removes the possibilities that a disease will ever occur. This may be achieved by modifying environmental and behavioural risk factors through mass education<sup>53</sup> in susceptible individuals or populations.<sup>52</sup> There are two main primary prevention strategies include high-risk and population approaches.

#### **SECONDARY PREVENTION**

Refers to action which<sup>66</sup> halts the progress of a disease at its incipient stage and prevents complication". The specific interventions are early diagnosis and adequate treatment which may reverse the disease or reduce its progression and the development of complications.

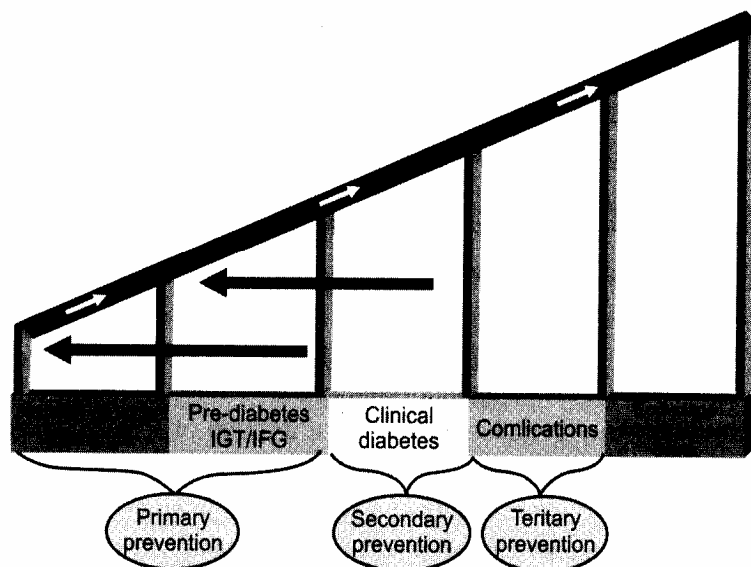


FIGURE 26.1: Stages in the natural history of diabetes

### TERTIARY PREVENTION

Defines as “all measures available to reduce or limit impairments, diabetic complications and disabilities, there by minimising and controlling suffering caused by diabetes and to rehabilitate the patients.

### PRIMARY PREVENTION STRATEGIES FOR PREVENTION OF DIABETES

Burden of diabetes in the community will be reduced by primary prevention programmes which are aimed at lifestyle modifications in delaying or preventing diabetes successfully. However, it has been acknowledged that very few diabetes primary prevention intervention trials have been conducted demonstrated positive results (Figure 26.2, Plate 1).

### HIGH-RISK STRATEGY

A high-risk strategy primarily aims to bring preventive care to individuals with a family history of diabetes who carry a genetic susceptibility, individuals with impaired glucose tolerance or pre-diabetes, ageing individuals, sedentary individuals and the large obese proportion of the population, certain ethnic groups who usually requires a screening tool or clinical methods to identify the risk. This approach has the advantage of directing appropriate interventions as well as providing potential motivation for individuals to make the necessary changes to reduce the impact of disease. A number of prospective studies conducted in impaired glucose tolerance subjects have shown a reduced progression to diabetes by controlling weight, diet and increasing exercise. Disadvantage

of the high-risk approach is that individual or group interventions are costly, need to be sustained for long periods and that it does not alter the underlying cause of the disease in the whole population as prevention and control measures are limited to those at risk.<sup>54</sup>

## **POPULATION STRATEGY**

The aim of this approach is to lower the mean level of risk for the entire population and influence favourably as a whole irrespective of individual risk levels by increasing physical activity, improving diet and reducing obesity. This not only increases the chance of preventing high-risk individuals from developing diabetes, but also reduces the chance of individuals with low-risk becoming high-risk.<sup>55</sup>

## **POPULATION STRATEGIES—EPIDEMIOLOGICAL EVIDENCE**

### **INTERVENTION PROGRAMMES**

Compelling evidence now exists that diabetes can be prevented or delayed in subjects with impaired glucose tolerance.<sup>56-59</sup> This evidence has held consistently across different populations, in different countries, among men and women, and in all age and racial and ethnic groups. Impaired glucose tolerance is the first stage in the course of diabetes and also a major problem from the quantitative point of view.<sup>37</sup> According to International Diabetes Federation, at least 300 million people worldwide have impaired glucose tolerance<sup>60</sup> and the prevalence varies widely from 3 to 10% in European population.<sup>61</sup> It is much higher in some newly industrialised nations and groups with high prevalence of diabetes, such as Asian Indians with the recent Chennai Urban Rural Epidemiology Study (CURES) noting a prevalence of IGT of 10.4%.<sup>62</sup> Subjects with impaired glucose tolerance (IGT) are at increased risk of developing diabetes and form an important high-risk group for actions aimed at preventing the disease.<sup>60, 63-65</sup>

Various studies like Diabetes Prevention Programme (DPP) demonstrated that both medication and lifestyle interventions can delay or prevent progression from impaired glucose tolerance (IGT) to diabetes.<sup>27</sup> The study also demonstrates the intensive lifestyle intervention reduced the incidence of diabetes by 58% compared to 31% reduction by metformin intervention.<sup>27</sup> The Da Qing study<sup>57</sup> compared diet, exercise, and diet plus exercise with a no-treatment control group and found that all three lifestyle approaches reduced the risk of developing diabetes by 31-46%. The Finnish Diabetes Prevention Study<sup>56</sup> of 522 overweight subjects with IGT showed that a lifestyle intervention designed to produce weight loss by improved dietary intake and physical activity reduced the risk of diabetes by 58%. The prospective study on the association between regular exercise and the subsequent development of diabetes in the US male physicians, demonstrates that exercise reduces the development of diabetes even after adjusting for BMI.<sup>66</sup> In the Malmo study,<sup>67</sup> BMI decreased by 2.4% in the intervention group and only 10.6% of the intervention group developed diabetes over 5 years compared with 28.6% of the control group.<sup>67-69</sup>

The American<sup>70</sup> and Finnish<sup>71</sup> prevention studies illustrate the benefits in a developed country. In a developing country, China, the Da Qing study also showed substantial preventive benefit of exercise, diet, or a combination of the two (P66). Various studies comparing lifestyle interventions and pharmacological therapies to prevent diabetes are currently underway.<sup>72</sup> However, implementing diabetes prevention in the general population is a challenging.

### **PROMOTION OF PHYSICAL ACTIVITY—EPIDEMIOLOGICAL EVIDENCE**

The intervention studies discussed above were carried out in a number of ethnic groups/populations and these studies have targeted either high-risk groups or were done in a research or clinical setting. However, implementation of such prevention programme at the community level presents a great challenge, but is the need of the hour. Community and population-based approaches have been tried in very limited number of studies and this is an area that needs further work, especially given the strong environmental components working to reduce physical activity and increase energy intake. Community-based interventions may be the most economically feasible, if they can be shown to be effective.

The community-based intervention programme was carried out in Asiad colony in Chennai city representing the middle-income group, which originated from an earlier study, called Chennai Urban Population Study (CUPS). To promote health in the community, awareness was created among the colony residents by various means such as, community education programmes were organised focused on adopting healthier lifestyles such as, healthier food choices and increased physical activity. Mass awareness camps were conducted which includes public lectures, skits, use of audio-visual aids. Education materials were distributed in the colony to increase the awareness. Family activities were encouraged in the community such as exposing children to the healthy life-style of the adults. And residents were encouraged to increase their regular physical activity such as walking programmes and emphasis was given to adhere to the programme. Having realised the importance of physical activity, the colony residents felt the need for increasing physical activity and constructed a park just adjacent to their colony by mobilising funds from various resources which included their own resources and donations from philanthropists (Figure 26.3). The park eventually turned out to be one of the most beautiful parks in the city of Chennai. Once the park was built, not only the residents of Asiad colony but several neighbouring colonies also started to walk regularly (Figure 26.4). The project was a remarkable success in terms of acceptability and local community participation and it markedly increased community awareness about the need for preventing diabetes and obesity.

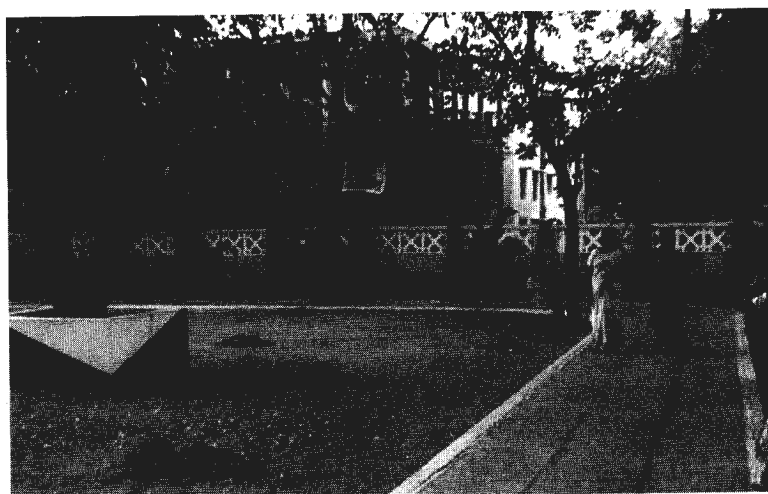
At baseline, only 14.2% of the residents exercised but these numbers increased to 46.9% at follow up (after 7 years) representing a ~300% increase in exercisers. The number of subjects who walked more than three times a week also increased from 13.8% at baseline to 52.1% during follow-up, representing a 277% increase. The per cent of subjects doing light grade activity have



**FIGURE 26.3:** The park constructed by the residents

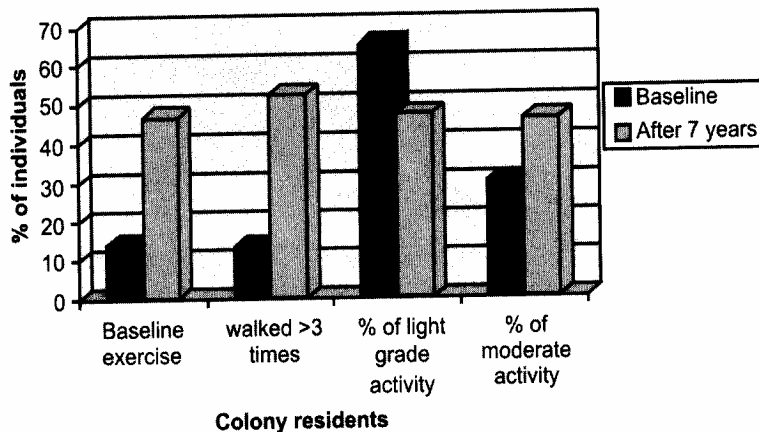
decreased from 64.9% at baseline to 47.1% during the follow-up. Those doing moderate activity have increased from 29.9% to 46.3%. And those doing heavy activity have also increased from 5.2% to 6.6% (Figure 26.4A).

This study showed an example of how, what started of as a research study had led to community action and thus underscores the importance of sharing research results with the community. This encourages the concept that research studies can be combined with awareness programmes and community empowerment, to improve physical activity levels of people.



**FIGURE 26.4:** The park with separate track for walkers





**FIGURE 26.4A:** Graph showing increased physical activity in the Asiad colony residents in a period of 7 years of awareness activity in the colony

This is the successful model for primary prevention of diabetes in a community setting and this community-based programme in south India to promote exercise reached the conclusion that the provision of physical activity facilities does enable people to be more active. Community-driven projects such as these may be the most effective means of bringing about lifestyle improvements in Indian population.

## NEW APPROACHES TO THE PROBLEM

### DEVELOPMENT OF THE INDIAN DIABETES RISK SCORE (IDRS)

The Indian Diabetes Risk Score helps in identifying undiagnosed diabetic subjects, which requires minimum time and effort but can help to considerably reduce the costs of screening. This was developed using four simple parameters namely age, abdominal obesity, family history of diabetes and leisure time physical activity.<sup>73</sup> This is of great significance as use of such scoring system could prove to be a cost-effective tool for screening of diabetes as it uses simple, safe and inexpensive measures. Moreover, it would help to do selective screening instead of universal screening and the cost saving would be of 50%. Further, use of such a risk score would be of great help in developing countries like India where there is a marked explosion of diabetes and over half of the cases remain undiagnosed diabetes.

### CONDUCT OF EXHIBITIONS

Conducting exhibitions emphasises the need for carrying the right messages regarding diabetes right down to the masses. Three major diabetes exhibitions have been organised in Chennai during the last 6 years<sup>74</sup> and one in Hyderabad in 2005, which have been attended by several lakhs of people.

## **PREVENTION AWARENESS COUNSELLING EVALUATION (PACE): A COMMUNITY OUTREACH DIABETES PREVENTION PROJECT**

A massive diabetes awareness and screening programme called the **PACE** (Prevention Awareness Counselling and Evaluation) diabetes project in Chennai is underway, is one of the largest awareness and prevention programmes on diabetes ever conducted at a community level.<sup>75</sup> The key aim of the programme is to implement a massive public awareness programme on diabetes reaching out to at least a million people and conduct large scale opportunistic screening of at least 200,000 people. Through this programme, large-scale public awareness campaigns were being conducted with active participation of the community through IEC activities (Information, Education and Communication) on diabetes health education, which are held at various places of the Chennai city. Programmes are organised on a daily basis in schools, colleges, youth organisations, factories and work places, cinema halls, temples, churches, mosques, bus stands, railway station, airport, fairs, shopping complex, banks, training centres and so on.

### **AWARENESS CAMPAIGNS**

Conducting community-wide campaigns helps to improve the health of communities by developing or strengthening social networks and by improving community member's sense of cohesion and collective ability to bring about change.

These campaigns are be large-scale, intense, highly visible, community-based with messages directed to large audiences through different types of media, including television, radio, newspapers, movie theatres, billboards, and mailings. Mass media appeared to be successful in promoting awareness and interest in exercising.

### **EDUCATION**

Education continues to be a key component in the prevention and treatment of diabetes. Low-cost educational material including pamphlets, posters, booklet, flash cards and CDs on diabetes have been developed in both English and the regional language (Tamil) are distributed to the public, free of cost (Figure 26.5A, Plate 2). A short documentary film has been produced on diabetes highlighting its causes, signs and symptoms, associated complications, management, prevention strategies and its social and economic impacts is telecast on various popular television and radio channels. These will help the person affected to make decisions that have a direct impact on their health.

Diabetes education empowers people with diabetes by encouraging them to take responsibility for their health and enabling them to manage their condition themselves.

### **EARLY DIABETES DETECTION BY SCREENING**

Diabetes can develop slowly over a period of years. And a person may be asymptomatic, but still develop diabetes-associated eye, kidney, or heart problems. Because of these serious long-

term consequences of diabetes, it is important to detect the disease early by screening in order to prevent or delay damage to heart, kidney, nerves, blood vessels, or eyes. With this early detection we may be able to take therapeutic measures, which will allow us to reverse or at least to slow down the rate of progression of the complications. To achieve this goal, a large scale-screening programme has been started (Figure 26.5).



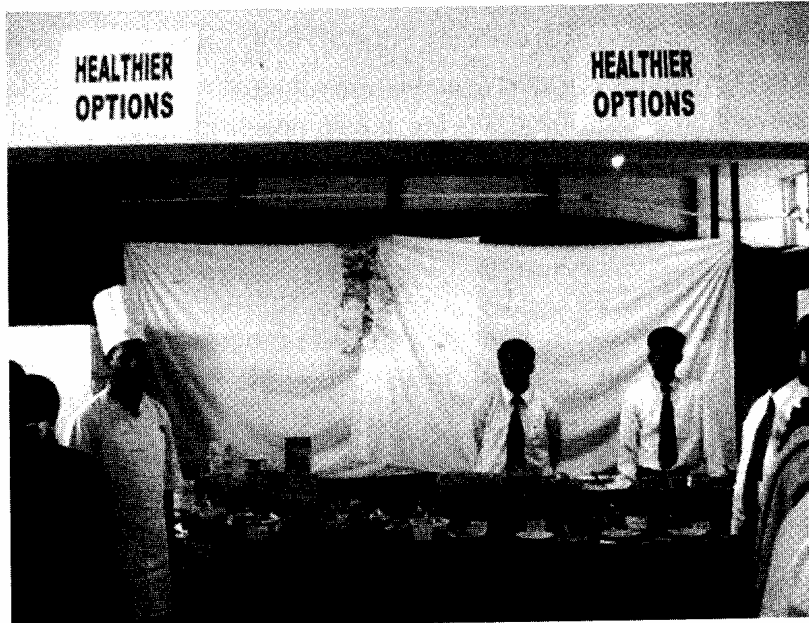
**FIGURE 26.5:** Conduct of mass screening programme for diabetes

## **RECOMMENDATION**

It is crucial to alert the public throughout the world that diabetes is a serious condition, which is currently underestimated in terms of frequency, impact on quality of life and in economic terms. Awareness at all levels and strata of society is the key to success and it is recommended that,

- Reducing access to elevators and escalators and placing the stairs in a more readily accessible and visible position.
- The growth of cycle lanes, walking tracks, improved lighting for recreational areas, televised fitness programmes, fitness centres and work place programmes can be designed to increase access to more acceptable exercise activities.
- Increasing awareness of foods low in fat, sugar and calories.

- Reintroducing traditional food items into the food market.
- Improving the accessibility and affordability of healthy foods.
- Easy availability of healthy food items.
- Promoting healthy food choices at social functions such as weddings, social gatherings, meetings and functions (Figures 26.6 and 26.7).



**FIGURE 26.6:** Promoting healthy food choices at social functions



**FIGURE 26.7:** Fibre rich foods at the healthy food counter

## CONCLUSIONS

Although studies in high-risk populations for certain diseases do offer the advantage of greater efficiency, nearly the entire population of India can be considered at high risk of diabetes, hypertension, atherosclerotic disease and other health conditions linked to obesity, physical inactivity and insulin resistance. The anticipated global benefits of weight reduction and increased physical activity, not only proposed for benefits of diabetes, but also cardiovascular diseases and hypertension, should argue for a population-based rather than high-risk intervention strategy. Hence, population-based primary intervention should be given the public health priority. The potential benefit of large-scale prevention of diabetes cannot be understated, provided the interventions can be delivered in a feasible and cost-effective manner.

## ACKNOWLEDGEMENTS

The Prevention Awareness Counselling Evaluation (PACE) programme supported by the Chennai Willingdon Corporate Foundation, Chennai, India. This is the 3rd paper from the PACE study.

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