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Pakistan National Diabetes Survey: Prevalence of glucose intolerance and associated factors in the Punjab Province of Pakistan

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ABSTRACT

Aims: The prevalence of diabetes mellitus and impaired glucose tolerance (IGT) and their relationship to age and obesity were estimated in Punjab, Pakistan by a population-based survey done in 1998.

Methods: Oral glucose tolerance tests were performed in a stratified random sample of 1852 adults aged ≥25 years. The diagnosis of diabetes and IGT were made on the basis of WHO criteria.

Results: The prevalence of diabetes was 12.14% in males and 9.83% in females. Overall total glucose intolerance (diabetes and IGT) was present in 16.68% males and 19.37% females. Central obesity, hypertension and positive family history were strongly associated with diabetes.

Conclusions: These results indicate that the prevalence of glucose intolerance is high in the studied population and comparable with the published data from the other three provinces of Pakistan i.e. Sindh, Baluchistan and North West Frontier Province, studied by the same group.

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1. Introduction

Diabetes is among the major causes of premature deaths; each year almost 1 million people die because of diabetes, two-thirds of these in developing countries [1]. Diabetes is rapidly growing worldwide. Amongst all the continents, Asia has the fastest growing number of people with diabetes with India, China, Pakistan and Japan having thirty-three, twenty-three, nine and seven million people with diabetes respectively. According to the World Health Organization (WHO) the number of people with diabetes in Asia will almost double in the next 20 years [2].

The prevalence of prediabetes is reported to be alarmingly high [3]. The prevalence of diabetes is high in Pakistan as reported in earlier three surveys conducted in the provinces of Sindh, Baluchistan and North West Frontier Province (NWFP) having 13.9%, 8.6% and 11.7% overall prevalence of type 2 diabetes comparable to other Asian populations [3–5].

This article documents the fourth and final phase of the national survey of diabetes and its risk factors in Pakistan which was conducted in the province of Punjab.

2. Materials and methods

The study was carried out in urban Multan and rural Mankot areas of the Punjab province of Pakistan. Multan has a population of around 3,100,000 (March, 1998 census). The residents are of low medium socio-economic status. Inhabitants are Punjabis and are permanent residents of the area. A small proportion of the population; around 2% are Mohajirs, who migrated to Pakistan at the time of the partition of the Indian sub-continent in 1947. Multan represents a relatively stable, urban community with a traditional lifestyle, in which most of the people have been residents for more than 10 years. Majority of the population are Muslims.

Mankot is a village situated around forty kilometers away from Multan with a population of approximately 70,000 people.

3. Study population selection criteria

The survey was carried out in March 1998. The survey team marked the households through stratified random sample. Names of all inhabitants aged 25 years and above were noted for each household. A second survey team consisting of the survey people and local teachers revisited every household, providing the members with detailed information about the survey and encouraging them to take part. The significance and value of the exercise were highlighted through printed leaflets. An informed consent was taken from the participants of the survey.

Methods for estimating blood glucose, blood pressure, body mass index (BMI) and waist hip ratio (WHR) along with the cut-off values have been published earlier [3–5].

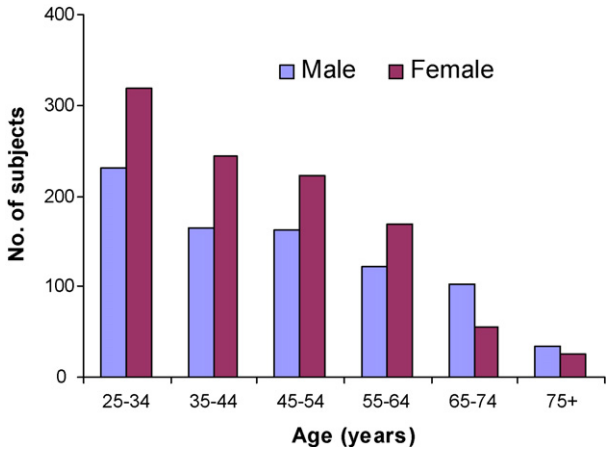

Fig. 1 – Age structure of the survey population.

4. Statistical methods

Data analysis was conducted with the statistical package for social sciences (SPSS) version 13.0. Values were presented in the form of mean ± S.D., frequencies and percentages. The difference between mean values was tested by observing the p-value using t-test. Chi-square test was used to measure the association between dichotomous variables. Values were considered statistically significant when p-value <0.05. Logistic regression was used to assess the risk assessment.

5. Results

A total of 1852 subjects were examined during the two phases of the survey representing a response rate of 44% and 56% for males and females respectively. The lower response rate in males was due to their inability to attend on working days. The most common reasons given by the non-responders for not participating in the survey were that they were healthy and did not require a medical examination or they did not want to give blood samples. The age distribution of males and females is shown in Fig. 1. Females can be seen to be relatively over-represented in the younger age groups.

6. Prevalence of abnormal glucose tolerance

The prevalence of diabetes and impaired glucose tolerance (IGT) by gender is shown in Table 1. Prevalence of previously diagnosed type 2 diabetes was 8.09% in males and 5.78% in females. Newly diagnosed type 2 diabetes was detected 4.05% in both males and females. Overall 12.14% of males and 9.83% of females were found to have diabetes. In addition 4.54% of males and 9.54% females had impaired glucose tolerance. The difference in the prevalence of abnormal glucose tolerance between males and females was found to be statistically non significant for diabetes ($p > 0.05$) and statistically significant for IGT ($p = 0.0001$).

Table 1 – Number of subjects, prevalence of diabetes, impaired glucose intolerance (IGT), by age and sex in Punjab, Pakistan.

Age (years)		Known diabetes	New cases of diabetes	Total cases of diabetes	Number with IGT
	n	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Women					
25–34	319	6 (1.88)	5 (1.57)	11 (3.45)	18 (5.64)
35–44	244	15 (6.14)	7 (2.86)	22 (9.01)	20 (8.19)
45–54	223	19 (8.52)	10 (4.48)	29 (13)	28 (12.55)
55–64	169	14 (8.28)	16 (9.46)	30 (17.75)	21 (12.42)
65–74	56	4 (7.14)	1 (1.78)	5 (8.92)	7 (12.5)
75+	26	2 (7.69)	3 (11.53)	5 (19.23)	5 (19.23)
All ages	1037	60 (5.78)	42 (4.05)	102 (9.83)	99 (9.54)
Men					
25–34	230	5 (2.17)	2 (0.86)	7 (3.04)	5 (2.17)
35–44	165	9 (5.45)	4 (2.42)	13 (7.87)	4 (2.42)
45–54	162	22 (13.58)	11 (6.8)	33 (20.37)	6 (3.7)
55–64	121	13 (10.74)	6 (4.95)	19 (15.7)	7 (5.78)
65–74	102	13 (12.74)	7 (6.86)	20 (19.6)	12 (11.76)
75+	35	4 (11.42)	3(8.57)	7 (20)	3 (8.57)
All ages	815	66 (8.09)	33 (4.05)	99 (12.14)	37 (4.54)

The prevalence for diabetes rose with age to a peak of 20.37% in males of 45–54 year age group and 19.23% in females of 75+ year age group. The prevalence for IGT rose with age to a peak of 11.76% in males of 65–74 year age group and 19.23% in females of 75+ year age group.

7. Factors associated with glucose tolerance

Subjects with abnormal glucose tolerance (both IGT and diabetes) were older than those with normal glucose tolerance in both sexes (Table 2).

Table 2 – Means and proportions for selected factors in men and women with normal glucose tolerance impaired glucose tolerance, and diabetes mellitus, Punjab, Pakistan.

Variable	Normal glucose tolerance	Impaired glucose tolerance	Diabetes mellitus
Women	*n* = 829	*n* = 99	*n* = 102
	Mean ± SD	Mean ± SD	Mean ± SD
Age (years)	42.18 ± 13.73	48.04 ± 14.61[c]	49.81 ± 11.97[c]
BMI (kg/m^2)	22.83 ± 4.67	24.1 ± 9.0[b]	25.5 ± 5.13[c]
WHR	0.89 ± .076	.901 ± .082	0.9519 ± 0.073[c]
	n (%)	*n* (%)	*n* (%)
BMI ≥ 25.0 (%)	244 (29.43)	35 (35.35)	47 (46.07)[c]
WHR ≥ 0.85 (%)	609 (73.46)	70 (70.70)	92 (90.19)[c]
F/H of DM (%)	66 (7.96)	1 (1.01)[b]	27 (26.47)[c]
Hypertensive (%)	224(27.02)	41 (41.41)[c]	47 (46.07)[c]
Men	*n* = 679	*n* = 37	*n*= 99
	Mean ± SD	Mean ± SD	Mean ± SD
Age (years)	44.05 ± 15.3	55.62 ± 16.4[c]	54.03 ± 14.24[c]
BMI (kg/m^2)	21.92 ± 3.98	21.37 ± 4.95	22.98 ± 4.2[b]
WHR	.894 ± .076	.897 ± .083	0.9441 ± 0.0831[c]
	n (%)	*n* (%)	*n* (%)
BMI≥27.0 (%)	71 (10.45)	6 (16.21)	15 (15.15)
WHR ≥0.95 (%)	161 (23.71)	10 (27.02)	49 (49.49)[c]
F/H of DM (%)	43 (6.33)	4 (10.81)	21 (21.21)[c]
[a]Hypertensive (%)	193 (28.42)	17 (45.94)[b]	49 (49.49)[c]

BMI, body mass Index; WHR, waist–hip ratio; F/H, Family history; DM, diabetes mellitus.
[a] Systolic blood pressure 140≥ and/or diastolic blood pressure ≥90 or on antihypertensive therapy.
[b] $p < 0.05$.
[c] $p < 0.01$.

Table 3 – Risk factors of diabetes with 95% CI.

	Odds ratio	95% CI	*p*-value	AOR	95% CI
Family history of DM	3.77	2.52–5.64	0.000	3.72	2.38–5.83
BMI ≥25	2.047	1.5–2.77	0.000	1.08	0.69–1.67
Male	1.185	0.883–1.59	0.258	1.93	1.2–3.11
Age ≥30	7.738	3.4–17.612	0.000	6.84	2.44–19.2
Hypertension	2.392	1.774–3.225	0.000	1.81	1.23–2.66
Smoking	1.1	0.787–1.538	0.577	0.79	0.51–1.23
Central obesity	2.252	1.638–3.097	0.000	2.06	1.35–3.45

Central obesity = whr ≥ 0.95 for males and whr ≥ 0.85 for females. AOR, adjusted odds ratio (adjusted for the variables in the table). CI, confidence interval.

High waist hip ratio (WHR) and Body mass index (BMI) were notably more prevalent in individuals with type 2 diabetes than those with normal glucose tolerance (Table 2).

In both sexes, there was a higher prevalence of positive family history of diabetes in subjects with type 2 diabetes than in subjects with normal glucose tolerance (males, 21.21% vs. 6.33% and females 26.47% vs. 7.96%). An intermediate proportion (10.81%) of males with IGT had a positive history whereas in females with IGT it was less than that seen in the subjects with normal glucose tolerance (Table 2).

The prevalence of hypertension was significantly associated with glucose tolerance status. Approximately one-half of the diabetic subjects were classified as hypertensive, as compared with less then 30% of subjects with normoglycaemia. Hypertension was significantly associated with IGT and diabetes (Table 2).

The risk of being diabetic for subjects with a positive family history of diabetes was found to be increased three folds, twice with high BMI, hypertension and high WHR. The risk increased seven folds for age greater than 30 years (Table 3).

8. Discussion

This is the report of the fourth and final phase of Pakistan National Diabetes Survey showing similar trend of high prevalence of abnormal glucose tolerance as observed in first three phases of the surveys done in other three provinces of Pakistan [3–5]. While a study based on ADA fasting blood glucose criteria reported relatively lower prevalence of diabetes (6.3%) and IFG (3.0%) in the province of Baluchistan [6]. The studies done on prevalence of diabetes in South Asians have shown a high prevalence as compared to the prevalence of diabetes in other populations [7,8]. The reason for this steep rise in Pakistan can be attributed to a number of factors, the most important being industrialization and urbanization and a change in lifestyle, both in urban and rural areas [9].

The population of Punjab has a high prevalence rate of IGT as found during early surveys in Sindh, Baluchistan and NWFP [3–5].

Prevalence of impaired glucose tolerance among females was twice than that of males ($p = 0.0001$). This finding is consistent with the findings of earlier survey in the area of shikarpur, Sindh Province of Pakistan [4]. This may be due to high prevalence of increased WHR observed in females of studied population.

The study population was diagnosed to have type 2 diabetes at young ages as compared to other parts of the world as reported in our earlier three surveys [3–5] as well as in other Asian studies [8,10,11].

Increased prevalence rate of type 2 diabetes and IGT with age in both sexes observed in this phase of the National Diabetes Survey is consistent with other South Asian studies. [8,10,12,13].

Positive family history of diabetes was found to be associated with abnormal glucose tolerance in this part of the survey as reported in other parts of the world [14,15] and during early surveys in Sindh, Baluchistan and NWFP [3–5]. This shows a strong association of the genetic factor with glucose tolerance [16].

The finding of a stronger association of central obesity rather than BMI (AOR; 2.06 vs. 1.08) with glucose intolerance (Table 3) is consistent with studies favoring central obesity as a greater risk factor for developing insulin resistance and diabetes [3]. In this study the overall prevalence of high WHR observed in women was approximately 90%. This may be related to higher fat intake and less physically active lifestyle of women in Punjab.

The relationship between hypertension and glucose intolerance is well documented. In this study, as well as in our previous three surveys [3–5] a marked association between these two risk factors was found with indication of gradient from normoglycemia through IGT to diabetes.

The burden of diabetes and IGT has emerged as a major health issue in Pakistan. The age group affected is the most productive period of life. The management of diabetes and its complications is a huge economic burden for people having very low priority to health along with ill developed health delivery system. There is an increasing need to determine the reasons of this high prevalence of abnormal glucose tolerance so that the measures can be taken that can alleviate the long-term health, economic and social consequences.

National programmes for primary prevention are needed. These programmes should aim to compile population-based data, monitor disease trends, and create an environment that is conducive to promoting healthy lifestyles through multi-sectoral, inter-disciplinary collaborations.

This survey was conducted around ten years ago as fourth and final phase of the National diabetes survey of Pakistan. The reports on first three surveys were published earlier individually. Furthermore, a complete report on the prevalence of diabetes amalgamating the data of all four provinces of Pakistan was also published in 2007 (16). But the individual data

of Punjab Province has remained unpublished. As it contains the important information, this needs to be disseminated to highlight the importance of primary prevention of diabetes at primary care level through early identification of risk factors and by addressing them through life style modifications. Furthermore the influences due to change in population size and urbanization along with insult of other environmental factors during last ten years should be kept in mind as the limitations of this study.

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