

Prevalence of diabetes, hypertension and renal disease amongst railway workers in Malaysia

Khalid B.A.K., MBBS, FRACP, Ph.D.
Associate Professor,

Norella Kong C.T., MBBS, FRACP.
Lecturer

Usha Rani*, MBBS
Medical Officer

Tariq Abdul Razak^o, MRCP, MD
Professor

Ng Mee Lian *, B.Sc., Ph. D.,
Lecturer

Departments of Medicine, Biochemistry* and Pharmacology^o,
Universiti Kebangsaan Malaysia, and Medical Clinic,* Malaysian Railways, Sentul

Summary

A survey was done to determine the prevalence of diabetes mellitus, hypertension and renal disease, as well as extent of diabetic control, amongst the workers of Malaysian Railways. The prevalence of diabetes was high at 6.6%, with 3.8% of these being insulin dependent diabetes. The highest prevalence was in Indians (16.0%) followed by Chinese (4.9%) and Malays (3.0%). Using HbA1c measurements, diabetic control was poor in 70.6% of the diabetics. Hypertension was found in 37% and proteinuria in 35%. Renal impairment was present in 30% of the diabetics. This survey shows that diabetes, hypertension and renal disease are high amongst the railway workers in Malaysia.

Key Words: Diabetes, hypertension, renal disease, prevalence, railway workers.

Introduction

There is a paucity of data regarding the prevalence of diabetes amongst the three major races in Malaysia. Estimates have put the prevalence at about 2%-3%,¹ but there are no proper population based studies as has been done in Singapore.² Earlier studies done in Malaysia by West and Kalbfleisch in 1966 suffered from not only small number of subjects tested (281 Malays, 127 Chinese, 144 Indians) but also from presuming there were few diabetics aged less than 35 years, and non-standard methodology.³ The oral glucose tolerance test consisted of oral glucose of 1 gm per kg body weight, and diabetes was diagnosed with a 2 hour blood glucose of greater than 8.3 mmol/L. The amount of glucose given was therefore variable, and the diagnosis of diabetes was more liberal than that recommended by the World Health Organisation (WHO) in 1985.⁴ Despite this, however, the prevalence of diabetes in Malays was 1.8%, Chinese 4.7% and Indians 4.2%. The prevalence reported for Chinese was thus high compared to that reported for Chinese in Singapore (1.6%) and in China (0.93%).^{2,5} The prevalence reported for Malays was slighter higher than that reported for Malays in Singapore (2.4%)² The Malays were most obese of the 3 races. More recently, a study was done to determine the prevalence of diabetes amongst

Malays in a rural area of Kuala Selangor, Malaysia using the WHO criteria.⁶ The prevalence of diabetes was 3.9% varying from 1% in the less than 35 years old, to 9.2% in the 55 years and older group. 60% of the subjects were newly diagnosed, and the prevalence was higher in the obese. A recent survey of diabetics attending the General Hospital Kuala Lumpur similarly found most Malays to be obese.⁷ This survey also found 37% of the patients to have hypertension. There is thus data to suggest the prevalence of diabetes is high amongst the 3 races in Malaysia and if the figure for 1966 were compared to those of Rampal et al,^{3,6} then there is a suggestion that diabetes is increasing at least amongst the Malays. There is some evidence to suggest an increase in the incidence and prevalence of diabetes with increasing affluence and food consumption, as seen in Taiwan, Japan and the Pacific Islands.^{8,9,10}

This study was done amongst the workers of the Malaysian Railway yards in Sentul, Kuala Lumpur, to determine the prevalence of diabetes, hypertension and renal disease amongst the workers.

Materials and Methods

The study was conducted at the Malaysian Railway Yards Depot, Sentul, in Kuala Lumpur, the capital of Malaysia. Both administrative and manual workers were included. With the cooperation of the Medical Health services, the Railways administration and Workers' Union, 97% of the workers responded and participated in the survey. All subjects were fasted overnight for at least 10 hours. All the subjects were also ensured to have a good night's sleep and not to be working on night shift.

This study was done following WHO criteria of 1985. All subjects except insulin dependent diabetics previously diagnosed were given 75 gm glucose drink after the overnight fast. Blood samples were taken at 2 hours and tested for plasma glucose, haemoglobin A_{1c} and renal profile (sodium, potassium, bicarbonate, urea, creatinine and uric acid). Urine samples were taken for glucose, and albumin, and for urine microscopic analysis if found positive for albuminuria. The patients were not allowed to smoke during the oral glucose tolerance test. Blood pressures were measured using a sphygmomanometer whilst the subjects were waiting for their blood tests. Blood glucose was measured by trained staff using the AMES Glucometer II and glucostix strips, as well as by plasma glucose using the Beckman's glucose analyser. Renal profile measurement was done using the Beckman's Systems Multi Analyser Channel II. Albuminuria was detected using the AMES "Albuminstix" Haemoglobin A_{1c} (HbA_{1c}) was measured using the colorimetric method recommended by the WHO and described elsewhere¹¹. Blood samples were also taken from 30 randomly selected subjects who were not hypertensive nor diabetic and analysed as per above.

The diagnostic criteria used for determination of diabetes was that of WHO⁴, that is, a plasma glucose 2 hours post 75 gm glucose drink 11.1 mmol/L or more. Hypertension was diagnosed if the blood pressure taken twice in the resting state was greater than 160/90 mmHg. Proteinuria was recorded as trace, +, ++, +++, and +++++, according to albuminstix chart. Significant proteinuria was taken as + proteinuria or more. Renal impairment was taken as present if the serum creatinine was greater than 110 μ mol/L with or without raised urea of greater than 7.0 mmol/L (normal ranges: Urea: 2.0 - 7.0 mmol/L; creatinine 40 - 110 μ mol/L).

Results

A total of 1996 subjects took part in the survey. This is almost 97% of the Railway workers. The age was 20 years to 58 years. There were 1262 Malays, 532 Indians, 164 Chinese and 38 others. The total number of diabetics detected was 132, or 6.6% of the total number surveyed. The total

number of impaired glucose tolerance (plasma glucose between 7.7 to 11 mmol/L) was 38, which is 1.9% of the total surveyed. Of the 132 diabetics detected, 109 were known diabetics who were on different types of treatment. There were 23 newly diagnosed diabetics, or 17.4% of the total number. There were 5 insulin dependent diabetics (Type I) which is 3.8% of the total number of diabetics. The number of males to females who were found to be diabetics was 115: 17, or 6.8: 1. The number of male to female workers however is greater than that, namely 22: 1.

The prevalence of diabetes was highest in the Indians. There were 85 diabetics out of 532 Indians, or 16.0%. The prevalence for Malays was 38 out of 1262 or 3.0%, that for Chinese was 8 out of 164 or 4.9%, and that for others was 1 out of 38 or 2.6%.

The mean ($\pm$ standard deviation) of the plasma glucose of the 30 normal subjects was 4.71 ± 1.00 mmol/L.

The mean ($\pm$ standard deviation) of the plasma glucose of diabetics and impaired glucose tolerance subjects was 9.52 ± 5.68 mmol/L. The correlation between plasma glucose as measured by the AMES glucometer was good (Pearson's correlation test, $r = 0.87$) but not excellent.

The mean ($\pm$ standard deviation) of glycosylated haemoglobin (HbA1) for the 30 non diabetics was 4.46 ± 0.66 umol HMF/l/gmHb. The normal range taken from this study (± 2 standard deviations) was thus 3.14 - 5.78 umol HMF/l/gmHb. This compared well to the normal range obtained for this method presented previously¹² where the range was 3.9 - 5.99 umol HMF/l/gmHb ($n = 40$). None of the 30 non-diabetic railway workers therefore had abnormal HbA1. The mean for HbA1 in the 132 diabetics was 6.50 ± 1.70 umol HMF/l/gmHb. The correlation between the plasma

Table 1 : Severity of albuminuria amongst diabetics in Malaysian railways workers

Type of Diabetic	Severity of Albuminuria					Total* Positive
	Trace	+	++	+++	++++	
Known Diabetic	6	12	7	Nil	Nil	19
Known Diabetic with Hypertension	7	12	2	3	1	18
New Diabetic	2	4	1	Nil	Nil	5
New Diabetic with Hypertension	Nil	Nil	1	3	Nil	4
TOTAL	15	28	11	6	1	46

* Trace albuminuria is not taken as positive of significant proteinuria in this study.

glucose taken for the study, and the glycosylated haemoglobin HbA1 was $r = 0.75$, $t = 6.2$ and $p < 0.001$. Glycosylated HbA1, which gives a measure of diabetic control for the preceding three months was high in 77 of the 109 known diabetics, indicating that 70.6% of the diabetics had poor diabetic control. Four of the newly diagnosed diabetics had normal HbA1.

Of the 132 diabetics detected in the survey, 49 or 37% had hypertension. Proteinuria was detected in 46 or 35% of the diabetics. The distribution of proteinuria amongst the diabetics are shown in Table 1. Thus 9 out of 23 new cases of diabetics and 37 out of the 109 known diabetics had significant proteinuria. There was no obvious correlation between proteinuria and hypertension, as it was equally distributed between those without and with hypertension. Forty (30%) of the diabetics had raised serum creatinine and urea indicating some degree of renal impairment. All of these had significant proteinuria.

Discussion

This survey confirms the suspicion that the prevalence of diabetes in Malaysians is higher than previously estimated^{1,3}, at least amongst the workers of the Malaysian Railways Depot in Sentul, Kuala Lumpur. The prevalence rate of 6.6% is high compared to many other parts of the world¹³. Such a high prevalence of diabetes has been reported however in the United States where the total rate was 6.9%¹⁴ in Jamaica (6.1%)¹⁵, Venezuela (7.0%)³ and Nauru (30%)¹⁰. This high prevalence rate is despite the stringent criteria of the WHO classification of diabetes.⁴ If the impaired glucose tolerance group (plasma glucose between 7.7 mmol/L and 11.0 mmol/L) were to be included, then the prevalence rate is even higher at 8.5%. This high prevalence rate however cannot be taken to be representative of the rest of Malaysia. The study population was highly selected - railway workers, where males predominate. Some studies showed diabetes to be more frequent in females¹⁶ although in Singapore and Malaysia they appear to be equal.^{2,6} The age range was also artificially low, for the upper limit of 58 years was due to the retirement age of 55 years for most workers. The age range for the population would be much higher than that and would include subjects above 65 years. Increasing the age range however would make the prevalence even higher, because the prevalence of diabetes increases with age and especially in the elderly^{14,17}.

The other reason why this survey is not representative of the Malaysian population is because of the urban setting, the area being the centre of Kuala Lumpur city. Another reason is the racial distribution: in this survey population, there were very few Chinese (164/1996 = 8.2% only) and more Indians (26.7%) than usually found in other parts of the country. The percentage of Malays (63.2%) was about representative. The percentage of Indians in the population is usually taken as 10% to 15%. The prevalence of diabetes in the Indians was very high at 16.0%. This is high when compared to the two other races, and to the prevalence of diabetes in Singapore Indians which was reported to be 6.1%.² However the prevalence of diabetes in the Indians of Fiji have been reported to be between 13.3% and 14.8%¹⁸ and amongst the Indians in South Africa to be between 11.1% and 19.1%.^{19,20} This high prevalence of diabetes amongst the Indian Railway workers contributed to the overall prevalence of 6.6% for the study population.

The prevalence of diabetes in the Malay workers was 3.0% and is higher than the 1.8% reported in 1966³ but comparable to the 2.4% prevalence of diabetes in the Singapore Malays (2) and the 3.9% prevalence in rural Malays of Kuala Selangor, Malaysia⁶.

The prevalence of diabetes in the Chinese railway workers was 4.9% which is not much different than the 4.7% reported by West and Kalbfleisch in 1966.³ This prevalence rate may have been high because of the small number of the sample (164 subjects). The prevalence rate reported for

Singapore Chinese, who are similar to the Kuala Lumpur Chinese, was 1.6% only and this rate was derived from a very large study involving about 12,500 subjects. ²

This study also found 17.4% newly diagnosed diabetics. Most of the diabetics were already diagnosed and treated. In the Kuala Selangor study, however, 60% of the diabetics were newly diagnosed. ⁶ This discrepancy could be due to the requirement of compulsory medical examination prior to employment amongst the railway workers, and to the easy availability of good medical care at the Railway Depot. In the rural Kuala Selangor, medical and health services were not so easily available.

This study also looked at the usefulness of measuring glycosylated haemoglobin HbA1 in determining or diagnosing diabetic state. None of the 30 normal workers had abnormal HbA1, but 4 of the 23 newly diagnosed diabetics had normal HbA1. Thus although HbA1 was specific, it was not sensitive enough to diagnose diabetes. The 4 new diabetics presumably had mildly elevated blood glucose for periods of less than 3 months, to enable the HbA1 to remain within the normal range.

Using the HbA1, the control of diabetes was determined to be poor in 77 of the 109 known diabetics who were receiving treatment. Thus 70.6% of the patients were poorly controlled, despite the easy access to medical advice and adequate facilities for medical treatment at the place of work.

A high percentage of the diabetics had hypertension (37%) and renal disease (30%). The percentage of diabetics with hypertension was exactly similar to that found amongst diabetics admitted into the General Hospital Kuala Lumpur, although the number with nephropathy was only 8%. ²¹ The high prevalence of renal disease amongst the diabetics working in the Malaysian Railways thus is significant and warrants further study. No attempt was made in this study to ascertain the cause of the renal impairment, although a large proportion of it would be due to diabetic nephropathy.

Acknowledgement

We thank Sazali Suratman and Kamarulzaman Hassan for their expert technical help, the Medical Officers for their assistance, and Mrs. Jamaliah Salleh for her untiring secretarial assistance. We thank the General Manager, Malaysian Railways, for permission and assistance in doing the project, and the Dean, Faculty of Medicine, UKM for permission to publish this paper.

References

1. King H., Bunnag SC., Fernando R, Mustaffa BE., Sukaton U., Yeo PPB., Buchanan RA., Zimmet P. A Review of the epidemiology of diabetes mellitus in the ASEAN region. IDF Bulletin 1983; 28:4-7
2. Cheah JS., Yeo PPB., Lui KF., Tan BY., Tan YT., Ngu YK. Epidemiology of diabetes in Singapore. Med J. Malaysia 1982; 37: 141-9
3. West KW., Kalbfleisch JM., Glucose tolerance, nutrition and diabetes in Uruguay, Venezuela, Malaysia and East Pakistan. Diabetes 1966., 15:9-18
4. Report of WHO Study Group on Diabetes Mellitus, Technical Report Series 727, World Health Organisation Geneva 1985.

5. Zhi-Sheng C. Some aspects of diabetes in the People's Republic of China, Part I. A perspective from Beijing in: J.I. Mann, K. Pyorala, A. Teusher (Eds). *Diabetes in Epidemiological Perspective*, Churchill Livingstone, Edinburgh 1983, pp. 78-86.
6. Rampal KG., Osman A., Lubis SH., Khalid BAK. A prevalence study of diabetes mellitus among rural Malays in Kuala Selangor, Malaysia, in: *Abstracts and Summaries, Third World Congress on Diabetes in the Tropics and Developing Countries*, Bangkok, Thailand 1984, F.2.
7. Chua IC., Khalid BAK. A survey of diabetes mellitus and its complications in the General Hospital Kuala Lumpur *Journal of ASEAN Fed. Endocr. Soc.* 1987; 6 : 74 - 81
8. Oiso T. Recent annual changes in nutrition in Japan in: S. Tsuji, M. Wada (Eds). *Diabetes Mellitus in Asia*. Excerta Medica. Amsterdam 190 pp. 234-42.
9. Tsai S. Epidemiology of Diabetes in Taiwan. *J.Jap. Diab. Soc.* 1971; 14:33-35.
10. Zimmet P., King H. Epidemiological studies of diabetes mellitus in Pacific Populations: A Review in: J. Tuomilehto, P. Zimmet, H. King, M. Pressley (Eds). *Diabetes Mellitus, Primary health Care, Prevention and Control*. IDF Publications (Ames Miles Division) Australia 1982 pp.8-21.
11. Ng ML., Sazali BS., Khalid BAK. Glycosylated Haemoglobin measurements by filter paper micro colorimetric method. *Journal of ASEAN Fed. Endocr. Soc.* 1986; 5: 33-37.
12. Kamarulzaman H., Ishak MS., Mazidah MZ., Khalid BAK. Glycosylated haemoglobin and diabetic control in Malaysia in: *Proceedings 3rd Congress Asean Fed. Endocr. Societies*, Kuala Lumpur 1985. F 15.
13. Ekoe JM., *Diabetes Mellitus - aspects of the World-wide Epidemiology of Diabetes Mellitus and its long Term Complications*. Elsevier Science Publishers, Amsterdam - New York - Oxford 1988.
14. National Diabetes Data Group, *Classification and diagnosis of diabetes mellitus and other categories of glucose intolerance*. *Diabetes*, 1979; 28: 1039-57.
15. Morrison EY., Alleyne SI. Factors related to the prevalence of hyperglycaemia in Jamaica: A preliminary report. *West Indian Med J.* 1980; 29:90-6.
16. West KM. *Epidemiology of Diabetes and its Vascular lesions*. Elsevier, New York 1978.
17. Bennet PH. *Diabetes in the elderly: Diagnosis and epidemiology*. *Geriatrics*, 1984; 39:37-41.
18. Ekoe JM. *Diabetes Mellitus: aspects of the World-wide epidemiology of Diabetes Mellitus and its long term complications*. Elsevier, Amsterdam 1988. pp.156.
19. Jackson WPU. *Epidemiology of diabetes in South Africa*. *Adv. Metab. Disord*, 1978; 9:111-46.
20. Seedat MA; Omar MAK, Dyer RB; Motala AA; Rajput MC., Joubert SM. The prevalence of diabetes mellitus in an urban Indian township of Durban, in *abstracts and summaries, Third World Congress on Diabetes in the Tropics and Developing Countries*, Bangkok 1984 F. 3.