Original Article

Association of low educational status with microvascular complications in type 2 diabetes: Jaipur diabetes registry-1

Niharikaa Sharma, Surendra Kumar Sharma[1], Vitthal D. Maheshwari, Krishna Kumar Sharma[2], Rajeev Gupta[2]

Department of Medicine, Mahatma Gandhi Medical College and Hospital, [1]Department of Endocrinology, Galaxy Specialty Centre, [2]Department of Medicine, Fortis Escorts Hospital, Jaipur, Rajasthan, India

ABSTRACT

Objective: To determine the association of educational status (ES), as a marker of socioeconomic status, with the prevalence of microvascular complications in diabetes. **Methods:** Successive patients (n = 1214) presenting to our centre were evaluated for sociodemographic, anthropometric, clinical, and therapeutic variables. Subjects were classified according to ES into Group 1 (illiterate, 216); Group 2 (<primary, 537), Group 3 (<higher secondary, 312), and Group 4 (any college, 149). Descriptive statistics are reported. **Results:** Mean age of patients was 52 ± 10 years, duration of diabetes 7 ± 7 years, and 55% were men. Prevalence of various risk factors was smoking/tobacco 25.5%, obesity body mass index ≥25 kg/m^2 64.0%, abdominal obesity 63.4%, hypertension 67.5%, high fat diet 14.5%, low fruits/vegetables 31.8%, low fibre intake 60.0%, high salt diet 16.9%, physical inactivity 27.5%, coronary, or cerebrovascular disease 3.0%, and microvascular disease (peripheral, ocular or renal) in 20.7%. Microvascular disease was significantly greater in illiterate (25.9%) and low (23.6%) compared to middle (15.0%) and high (14.7%) ES groups (P < 0.05). Age- and sex-adjusted logistic regression analysis revealed that in illiterate and low ES groups respectively, prevalence of smoking/tobacco use (odds ratio 3.84, confidence intervals 2.09–7.05 and 2.15, 1.36–3.41); low fruit/vegetable (2.51, 1.53–4.14 and 1.99, 1.30–3.04) and low fibre intake (4.02, 2.50–6.45 and 1.78, 1.23–2.59) was greater compared to high ES. Poor diabetes control (HbA1c >8.0%) was significantly greater in illiterate (38.0%), low (46.0%) and middle (41.0%) compared to high (31.5%) ES subjects (P < 0.05). **Conclusions:** There is a greater prevalence of the microvascular disease in illiterate and low ES diabetes patients in India. This is associated with the higher prevalence of smoking/tobacco use, poor quality diet and sub-optimal diabetes control.

Key words: Diabetes, micro vascular complication, socioeconomic status

Introduction

Diabetes and cardiovascular diseases are epidemic in India.[1] Both are increasing in prevalence and are important causes of disability of premature death. Although greater focus has been on macrovascular cardiovascular disease in diabetes (coronary heart disease, stroke, and large artery peripheral arterial disease), its microvascular complications (retinopathy, nephropathy, neuropathy, and small-artery peripheral arterial disease) are more disabling as well as more amenable to prevention.[2]

Corresponding Author: Dr. Surendra Kumar Sharma, Department of Endocrinology, Galaxy Specialty Centre, Ajmer Road, Sodala, Jaipur - 302 006, Rajasthan, India.
E-mail: sksharma7@gmail.com

Access this article online	
Quick Response Code:	Website: www.ijem.in
	DOI: 10.4103/2230-8210.163206

Cite this article as: Sharma N, Sharma SK, Maheshwari VD, Sharma KK, Gupta R. Association of low educational status with microvascular complications in type 2 diabetes: Jaipur diabetes registry-1. Indian J Endocr Metab 2015;19:667-72.

It has been previously reported that in India cardiovascular risk factors (smoking, physical inactivity, obesity, hypertension, hypercholesterolemia and diabetes) are more in high socioeconomic status (SES) subjects.[3] However, recent studies have reported that because of ongoing social and economic development and associated chronic disease transition some of these risk factors such as smoking, unhealthy diet, and hypertension are now more prevalent among the lower SES populations.[4] It has also been reported that diabetes is now equally prevalent in high and low SES subjects in India, especially in urban populations.[5,6] In Europe and North America, reduction of vascular risk factors in diabetic subjects among the higher social classes, mostly due to greater awareness and better treatments, has led to decline in vascular disease incidence, and mortality, and vascular disease in now more common in patients in lower SES.[7] Influence of SES on diabetes and its associated vascular complications has not been well studied in India.[8] Microvascular complications are more among South Asians in India as compared to Mauritius and England.[9] A study in South India reported that the diabetes complications, including peripheral arterial disease was more among the low SES subjects.[10] However, there are no studies that have evaluated the influence of education, a reliable marker of SES, on development and progression of vascular complication in diabetes. Therefore, to determine the prevalence of vascular complication among diabetic urban Indian populations and to study influence of educational status (ES), as marker of SES, on vascular risk in diabetes, we performed a registry-based study at a tertiary care centre in India.

Methods

We evaluated the prevalence of vascular disease in urban diabetic patients at tertiary care diabetes centre at Jaipur in North-West India. The study protocol was approved by the institutional ethics committee and written informed consent was obtained from each participant. The performa focused on sociodemographic characteristics (occupation, educational, and social status), family history of cardiovascular disease, stroke, hypertension, and self-reported details of smoking, alcohol intake, physical activity, visible dietary fat, vegetables, and fruit intake, hypertension, lipid abnormalities, and cardiovascular diseases. Measurements included height, weight, waist, hip, and sitting blood pressure (BP) using methodologies prescribed by the World Health Organization.[11]

All successive patients evaluated at our tertiary care centre over a 6-month period from January to June 2013 were included in the study. The study performa were filled by a trained research worker. Apart from demographic history, details of SES based on ES and years of formal education were inquired. Smoking details were inquired for the type of smoking or nonsmoked tobacco use, a number of cigarettes/bidis smoked, and years of smoking. Intake of alcohol was assessed as drink per week, dietary fat was assessed using questions about the type of cooking oil used and estimated as visible fat intake (g) daily. Fat, calories, fruit, and vegetable intake were assessed by a simple question that inquired number and quantity of serving in a week. Details of physical activity were assessed by questions for the exact daily duration (minutes) of work-related- commute-related- and leisure-time physical activity. All the equipment for measurements of height, weight, waist, and hip size and BP were similar and calibrated throughout the study tenure to ensure uniformity.[6] Physical examination emphasized measurement of height using stadiometer, weight using calibrated spring weighing machines, waist, and hip were measured using spring tapes and sitting BP measured after at least 5 min rest using Omron SDX (Omron Inc., USA) BP instruments. Three readings were obtained and were averaged for the data analysis. A fasting blood sample was obtained from all individuals after 8–10 h fasting. Cholesterol, high density lipoprotein cholesterol, and triglyceride levels were measured using enzyme-based assays with internal and external quality control.

Diagnostic criteria

SES was categorized according to the years of education and the study cohort was divided into four groups: Group 1: Illiterates, Group 2: 1–5 years education (primary), Group 3: 6–12 years education (secondary/higher secondary), and Group 4: >12 years education (college or more). Such classification has been validated in previous epidemiological studies in India and correlates with income, asset ownership, and housing.[12] Smokers included subjects who smoked cigarettes, bidis, or other smoked forms of tobacco daily, past smokers were subjects who had smoked for at least 1-year and had stopped more than a year ago. Users of other forms of tobacco (nasal, oral, etc.) were classified as nonsmoked tobacco use. Subjects consuming more than 20 g visible fat daily were categorized as high fat intake and those consuming ≤2 servings of fruits or vegetables daily as low intake. Those with no regular work-related or leisure-time physical activity were classified as having physical inactivity. Overweight or obesity was defined as body mass index (BMI) ≥25 kg/m^2, abdominal obesity was diagnosed when waist: hip ratio was >0.9 in men and >0.8 in women or waist circumference was >90 cm in men and >80 cm in women, according to the harmonized definition of metabolic syndrome. Hypertension was diagnosed when systolic BP was ≥140 mmHg and/or diastolic BP ≥90 mmHg, or a person was a known hypertensive. Coronary artery disease

and stroke was classified when a person was having either of the two with physician-based diagnosis using standard clinical, and investigative criteria, and peripheral arterial disease when ankle brachial index <0.9 or by presence of intermittent claudication. Microvascular disease included either the presence of proliferative retinopathy as assessed by fundus examination, or nephropathy diagnosed when albuminuria >300 mg/day or neuropathy when vibration perception threshold >25 mV.

Statistical analyses

All the case-report form data were transferred into an SPSS database (version 13.0, SPSS Inc., Chicago, USA). Numerical variables are reported as either mean ± 1 standard deviation or median and interquartile range. Categorical variables are reported as a percent. Intergroup comparisons were performed using Chi-square for categorical variables. To determine the significance of differences in risk factors in various educational groups, the prevalence of risk factors in the highest educational group was compared with a medium, low, and illiterate groups after age- and sex-adjustment using logistic regression. Odds ratio (OR) and 95% confidence intervals (CIs) were calculated. *P* value of < 0.05 was considered significant.

Results

Mean age of subjects was 52 ± 10 years, mean duration of diabetes was 7 ± 7 years, and 55% of the patients were men [Table 1]. Prevalence and 95% CI of various cardiovascular risk factors in the study cohort was high fat diet in 14.5% (12.5–16.5%), low fruits/vegetables intake 31.8% (29.2–34.4%), low fibre intake 60.0% (57.2–62.7%), high salt diet 16.9% (14.8–19.0%), physical inactivity 27.5% (25.0–30.0%), smoking, and/or tobacco use 25.5% (23.1–27.9%), overweight/obesity BMI ≥25 kg/m^2 64.0% (61.3–66.7%), abdominal obesity with high waist size 63.4% (60.7–66.1%), hypertension 67.5% (64.9–70.0%), and any coronary or cerebrovascular disease 3.0% (2.1–3.9%).

Prevalence of various lifestyle and other risk factors in men and women in different ES groups is shown in Table 1. Smoking and/or tobacco use, low fruit and vegetables intake, and low fiber intake is significantly greater among the illiterate and low ES groups in both men and women. Men and women in high and medium ES groups have a greater intake of dietary calories, fats, salt and alcohol and have a greater prevalence of abdominal obesity as well as generalized obesity. While smoking and tobacco use is significantly greater in lower ES patients, the prevalence of other lifestyle risk factors is similar [Figure 1a]. Prevalence of various anthropometric risk factors overweight, obesity, abdominal obesity, and hypertension is also not dissimilar across various ES groups [Figure 1b].

To identify the relative prevalence of various risk factors in different groups, we performed multivariate age- and sex-adjusted logistic regression analysis [Table 2]. As compared to higher ES Group 4 (OR 1.00), the prevalence of smoking/tobacco use was significantly greater in Group 1 (OR 3.84, CI 2.09–7.05), and Group 2 (OR 2.15, CI 1.36–3.41). Low fruit/vegetable intake was also more in Group 1 (OR 2.51, CI 1.53–4.14) and Group 2 (OR 1.99, CI 1.30–3.04) as was low fibre intake in Group 1 (OR 4.02, CI 2.50–6.45) and Group 2 (OR 1.78, CI 1.23–2.59) (all $P < 0.01$). Among the illiterate and low ES groups, the prevalence of abdominal obesity (Group 1: OR 0.38, CI 0.18–0.82; Group 2: OR 0.75, CI 0.40–1.39), and overweight/

Table 1: Prevalence of lifestyle and cardiovascular risk factors in the diabetes patients

Variables	Educational status groups							
	Male				Female			
	Illiterate (*n*=47)	Low (*n*=278)	Middle (*n*=237)	High (*n*=111)	Illiterate (*n*=169)	Low (*n*=259)	Middle (*n*=75)	High (*n*=38)
Smoking/tobacco	23 (48.9)	134 (48.2)	86 (36.3)	34 (30.6)	21 (12.4)	11 (4.2)	01 (1.3)	0 (0.0)
High fat diet	5 (10.6)	46 (16.5)	43 (18.1)	24 (21.6)	12 (7.1)	27 (10.4)	14 (18.6)	5 (13.1)
High calorie diet	6 (12.7)	51 (18.3)	53 (22.3)	29 (26.1)	20 (11.8)	42 (16.2)	16 (21.3)	6 (15.8)
Low fruit/vegetable intake	21 (44.7)	94 (33.8)	68 (28.7)	29 (26.1)	62 (36.7)	93 (35.9)	14 (18.7)	5 (13.1)
Low fiber diet	37 (78.7)	179 (64.4)	138 (58.2)	55 (49.5)	124 (73.4)	141 (54.4)	38 (50.7)	16 (42.1)
High salt intake	5 (10.6)	58 (20.8)	43 (18.1)	21 (18.9)	24 (14.2)	39 (15.0)	7 (9.3)	8 (21.0)
Alcohol intake	4 (8.5)	38 (13.7)	29 (12.2)	14 (12.6)	1 (0.6)	3 (1.1)	1 (1.3)	1 (2.6)
Physical inactivity	9 (19.1)	75 (27.0)	55 (23.2)	18 (16.2)	56 (33.1)	90 (34.7)	19 (25.3)	12 (31.6)
Waist size >90/>80	23 (48.9)	165 (59.3)	164 (69.2)	63 (56.7)	125 (73.9)	158 (61.0)	49 (65.3)	23 (60.5)
BMI ≥25 kg/m^2	18 (38.3)	159 (57.2)	151 (63.7)	75 (67.5)	101 (59.7)	182 (70.2)	58 (77.3)	33 (86.8)
BMI ≥30 kg/m^2	5 (10.6)	52 (18.7)	46 (19.4)	18 (16.2)	32 (18.9)	87 (33.6)	18 (24.0)	14 (36.8)
Hypertension	24 (51.0)	178 (64.0)	160 (67.5)	61 (54.9)	126 (74.5)	193 (74.5)	51 (68.0)	27 (71.0)
High cholesterol >200 mg/dL	2/12 (16.7)	15/104 (14.4)	15/85 (17.6)	6/93 (14.0)	6/31 (19.4)	17/80 (21.3)	7/36 (19.4)	1/10 (10.0)

Numbers in parentheses are percentage. BMI: Body mass index

obesity (Group 1: OR 0.33, CI 0.20–0.53; Group 2: OR 0.56, CI 0.37–0.85) was significantly lower.

Microvascular disease (proliferative retinopathy, albuminuria >300 mg/day, or peripheral neuropathy) was present in 20.7% (95% CI 18.4–23.0%). The prevalence was significantly greater in illiterate (25.9%, CI 20.1–31.7%) and low ES groups (23.6%, CI 20.0–27.2%) as compared to middle (15.0%, CI 11.0–18.9%) and high (14.7%, CI 9.0–20.4%) ES groups ($P < 0.05$) [Figure 2]. Among the illiterate, the low, medium, and high ES groups, respectively, the prevalence of retinopathy was 17.1%, 12.8%, 8.4%, and 10.1%, nephropathy was 2.3%, 2.6%, 2.6% and 0.0% and neuropathy or diabetic foot was in 14.3%, 15.1%, 5.4% and 8.1% respectively. The quality of diabetes control is shown in Figure 3. Among the illiterate and low ES groups there are significantly more patients with poor diabetes control (HbA1c >9.0%) and lesser patients with desirable diabetes control (HbA1c <7.0%). For the overall study cohort, poor diabetes control (HbA1c >9%) was significantly greater among the illiterate (38.0%, CI 31.5–44.8%), low ES (46.0%, CI 41.8–50.2%) and middle ES patients (41.0%, CI 35.5–46.4%) as compared to high ES patients (31.5%, CI 24.0–38.9%) ($P < 0.05$). ORs and 95% CIs for the prevalence of microvascular complications in various groups are shown in Table 3. Significantly greater ORs are observed in illiterate and lower ES groups as compared to higher ES. There is a significant increase after adjustment for the degree of diabetes control (HbA1c levels) as well as risk factors.

We also assessed the use of various pharmacotherapies among various ES groups. In illiterate versus low, middle, and high ES patients, respectively, there was greater use of more expensive medications-insulin (34.7%, 30.9%, 24.3% and 22.1%), and angiotensin converting enzyme (ACE) inhibitors, or angiotensin receptor blockers (57.9%, 53.2%, 52.2%, and 47.0%) (P for trend < 0.05). Use of other oral hypoglycemic agents was similar.

Discussion

This study shows greater prevalence of microvascular complications of type 2 diabetes mellitus among the patients belonging to low ES compared with the better educated patients. Low ES patients have greater prevalence of smoking or tobacco use, low fruits, and vegetables intake, and have poorer diabetes control.

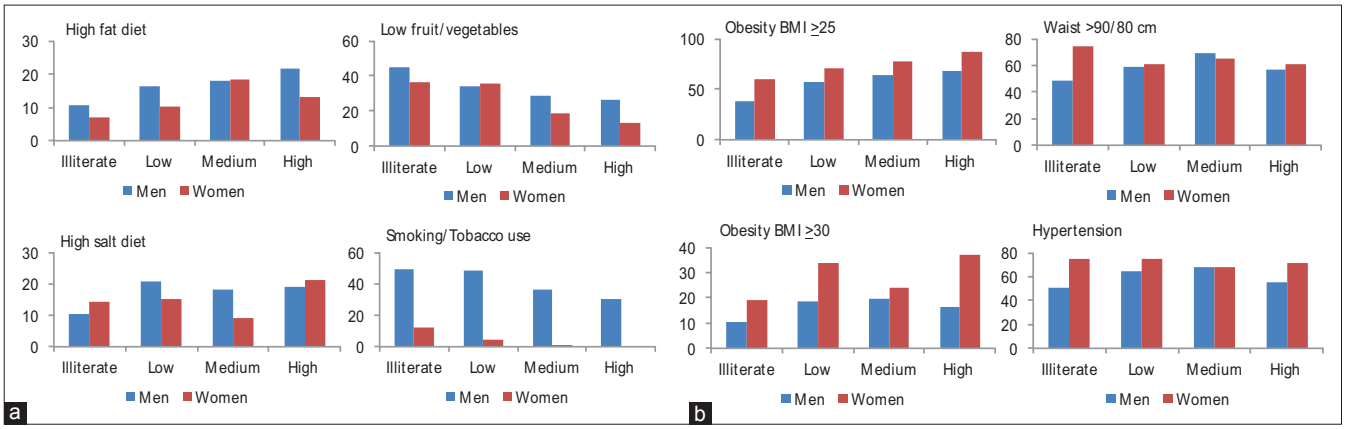

Figure 1: Prevalence of various lifestyle (a) and anthropometric (b) risk factors among illiterate, low, medium and high educational status groups

Table 2: Age- and sex-adjusted OR and 95% CI for prevalence of lifestyle and cardiovascular risk factors in middle, low and illiterate groups compared to high educational status

Variables	Education status			
	High	Medium	Low	Illiterate
Smoking/tobacco use	1.00	1.33 (0.83-2.15)	2.15 (1.36-3.41)	3.84 (2.09-7.05)
High fat intake	1.00	0.98 (0.59-1.62)	0.76 (0.47-1.24)	0.49 (0.25-0.97)*
High calorie intake	1.00	0.97 (0.61-1.54)	0.75 (0.48-1.18)	0.54 (0.30-0.98)*
Low fruit/vegetable intake	1.00	1.25 (0.79-1.99)	1.99 (1.30-3.04)**	2.51 (1.53-4.14)**
Low fiber intake	1.00	1.44 (0.97-2.14)	1.78 (1.23-2.59)**	4.02 (2.50-6.45)***
Physical inactivity	1.00	1.22 (0.75-1.97)	1.56 (1.00-2.44)	1.31 (0.78-2.20)
Abdominal obesity	1.00	1.01 (0.53-1.92)	0.75 (0.40-1.39)	0.38 (0.18-0.82)*
Overweight/obesity	1.00	0.78 (0.50-1.20)	0.56 (0.37-0.85)**	0.33 (0.20-0.53)***
Hypertension	1.00	0.84 (0.49-1.43)	0.86 (0.51-1.43)	0.55 (0.30-1.02)
High cholesterol	1.00	1.41 (0.55-3.57)	1.28 (0.52-3.16)	1.28 (0.40-4.10)

*P<0.05, **P<0.01, ***P<0.001. OR: Odds ratio, CI: Confidence interval

Table 3: OR of prevalence of microvascular complications in various educational status groups after statistical adjustments for age, sex, diabetes control and lifestyle risk factors

	High	Medium	Lower	Uneducated
Unadjusted	1.00	1.02 (0.59-1.77)	1.79 (1.10-2.93)*	2.02 (1.17-3.48)*
Age- and sex-adjusted	1.00	0.94 (0.54-1.64)	1.74 (1.05-2.88)*	1.98 (1.12-3.57)*
Age, sex and HbA1c adjusted	1.00	1.24 (0.65-2.34)	1.99 (1.10-3.26)*	2.84 (1.46-5.53)*
Age, sex, HbA1c and lifestyle factors adjusted	1.00	1.11 (0.54-2.27)	2.36 (1.19-4.65)*	2.37 (1.11-5.05)*

*P<0.05, OR: Odds ratio

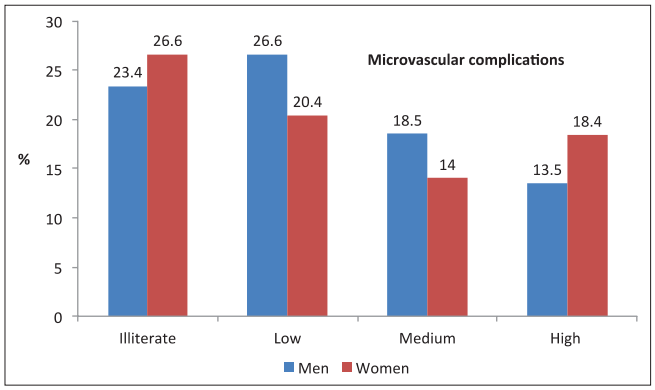

Figure 2: Prevalence of macrovascular and microvascular disease among illiterate, low, medium and high educational status groups

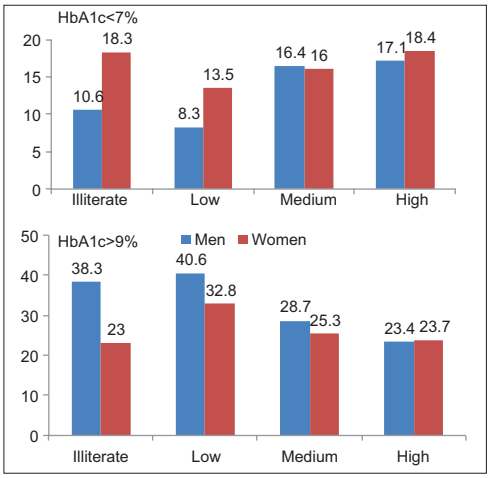

Figure 3: HbA1c levels in various educational group subjects

Globally, a number of studies have reported a greater incidence, and prevalence of microvascular complications in low SES patients.[13,14] Studies performed in Europe and other developed countries have reported disparities in incidence and management of diabetes with greater complications in low SES individuals. Ricci-Cabello *et al*. performed a systematic review of studies which reported social inequalities in the prevention, diagnosis, treatment, control, and monitoring of diabetes.[13] The authors selected 41 articles from which 25 studies (18 cross-sectional, 6 cohorts, 1 case–control) were reviewed in detail. There was evidence of ethnic inequalities in treatment, metabolic control, and use of healthcare services. Socioeconomic inequalities were also found in the diagnosis and control of the disease. This review shows that even in countries with a significant level of economic development with universal healthcare systems socioeconomic, and ethnic inequalities can be identified in the provision of health-care in diabetes.[13] Grintsova *et al*. performed a review to assess the association of individual SES with inequalities in healthcare in diabetes patients,[14] and reported a negative association of SES with access to treatment and diabetes control.

In India, Ramachandran *et al*., studied socioeconomic differentials in diabetes complications, and reported greater complications associated with inferior diabetes control in low SES patients with diabetes.[10] These results are similar to our study. However, all our patients had access to a tertiary care centre. We did not inquire regarding regularity of follow-up although poorer diabetes control as reflected by higher HbA1c levels in low ES patients suggests that poor quality of self-management or lack of access to healthcare. Qualitative studies are required to clarify these issues. India heart watch study has reported that diabetes awareness, treatment, and control is lower among the low ES urban men and women in different regions of the country.[15] Low level of control of major cardiovascular risk factors-hypertension, and hypercholesterolemia-was also reported in this study.[16]

Other reasons for greater incidence of cardiovascular complications as well as microvascular complications in poor and low ES patients with diabetes include greater prevalence of smoking, nonsmoked tobacco use, poor quality diet, less physical activity, environmental toxins and other social determinants of health.[17] Our study shows that greater smoking or tobacco use as well as low intake of heart healthy fruits and vegetables among low ES patients are important. We did not study social determinants of health other than ES to categorize SES and this is a study limitation. These social determinants include macrolevel (social organization, the economy, work environment, transport, national, and regional human, or social development indices, etc.), individual level factors (poverty, stress, life-course social gradient, psychosocial work environment, social support, and social cohesion, food, and nutrition, social exclusion, social patterning of individual health behaviors, and smoking, etc.).[18] ES has been used the most in cardiovascular

epidemiological studies as a marker of SES as it is stable after early childhood and least influenced by social changes or illness in adulthood.[19] Other limitations of the study include the cross-sectional design, small sample size, single site study and lack of long term treatment data. We also do not have data on all the risk factors (lipid abnormalities, and genetic markers of complications, etc.) and microvascular complications (ocular fundus photographs, urinary albumin-creatinine ratio, and nerve conduction studies, etc.) which are the markers of early disease. On the other hand, this is one of the larger studies from India, and we have significant data on risk factors and major complications. Large prospective multisite diabetes registries in the country are needed to confirm our findings.

Conclusion

This study shows that the microvascular complications are widely prevalent in type 2 diabetes patients in India, the complications are more among the low ES (low SES) patients, and high prevalence of lifestyle risk factors is important. Additionally, this study shows that low ES patients are also burdened with the greater use of costlier medicines (ACE inhibitors/receptor blockers and insulin) similar to previous reports from India.[20] This burden can be reduced with the greater use of cardiovascular preventive strategies in these patients.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Patel V, Chatterji S, Chisholm D, Ebrahim S, Gopalakrishna G, Mathers C, *et al.* Chronic diseases and injuries in India. Lancet 2011;377:413-28.
2. Buse JB, Ginsberg HN, Bakris GL, Clark NG, Costa F, Eckel R, *et al.* Primary prevention of cardiovascular diseases in people with diabetes mellitus: A scientific statement from the American Heart Association and the American Diabetes Association. Circulation 2007;115:114-26.
3. Gupta OP, Joshi MH, Dave SK. Prevalence of diabetes in India. Adv Metab Disord 1978;9:147-65.
4. Gupta R, Gupta KD. Coronary heart disease in low socioeconomic status subjects in India: "An evolving epidemic". Indian Heart J 2009;61:358-67.
5. Gupta R, Kaul V, Agrawal A, Guptha S, Gupta VP. Cardiovascular risk according to educational status in India. Prev Med 2010;51:408-11.
6. Gupta R, Deedwania PC, Sharma K, Gupta A, Guptha S, Achari V, *et al.* Association of educational, occupational and socioeconomic status with cardiovascular risk factors in Asian Indians: A cross-sectional study. PLoS One 2012;7:e44098.
7. Yusuf S, Reddy S, Ounpuu S, Anand S. Global burden of cardiovascular diseases: Part I: General considerations, the epidemiologic transition, risk factors, and impact of urbanization. Circulation 2001;104:2746-53.
8. Shrivastava U, Misra A, Gupta R, Vishwanathan V. Socioeconomic factors relating to diabetes and its management in India. J Diabetes 2015 May 28. doi: 10.1111/1753-0407.12316.
9. Potluri R, Purmah Y, Dowlut M, Sewpaul N, Lavu D. Microvascular diabetic complications are more prevalent in India compared to Mauritius and the UK due to poorer diabetic control. Diabetes Res Clin Pract 2009;86:e39-40.
10. Ramachandran A, Snehalatha C, Vijay V, King H. Impact of poverty on the prevalence of diabetes and its complications in urban southern India. Diabet Med 2002;19:130-5.
11. Luepkar RV, Evans A, McKeigue P, Reddy KS. Cardiovascular Survey Methods. 3rd Ed. Geneva. World Health Organization. 2002.
12. Gupta R, Gupta VP, Ahluwalia NS. Educational status, coronary heart disease, and coronary risk factor prevalence in a rural population of India. BMJ 1994;309:1332-6.
13. Ricci-Cabello I, Ruiz-Pérez I, Olry de Labry-Lima A, Márquez-Calderón S. Do social inequalities exist in terms of the prevention, diagnosis, treatment, control and monitoring of diabetes? A systematic review. Health Soc Care Community 2010;18:572-87.
14. Grintsova O, Maier W, Mielck A. Inequalities in health care among patients with type 2 diabetes by individual socio-economic status (SES) and regional deprivation: A systematic literature review. Int J Equity Health 2014;13:43.
15. Gupta R, Sharma KK, Gupta BK, Gupta A, Gupta RR, Deedwania PC. Education status related disparities in awareness, treatment and control of cardiovascular risk factors in India. BMJ Heart Asia 2015;7:1-6.
16. Gupta A, Gupta R, Sharma KK, Lodha S, Achari V, Asirvatham AJ, *et al.* Prevalence of diabetes and cardiovascular risk factors in middle-class urban participants in India. BMJ Open Diabetes Res Care 2014;2:e000048.
17. Leon D, Walt G. Poverty, Inequality and Health: An International Perspective. Oxford: Oxford University Press; 2001.
18. Marmot M, Wilkinson S. Social Determinants of Health. Oxford: Oxford University Press; 1999.
19. Kaplan GA, Keil JE. Socioeconomic factors and cardiovascular disease: A review of the literature. Circulation 1993;88 (4 Pt 1):1973-98.
20. Ramachandran A, Ramachandran S, Snehalatha C, Augustine C, Murugesan N, Viswanathan V, *et al.* Increasing expenditure on health care incurred by diabetic subjects in a developing country: A study from India. Diabetes Care 2007;30:252-6.