

Diabetes and hypertension - A comprehensive assessment among workers in selected tea plantations, South India

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ABSTRACT

Background: Non-communicable diseases, especially diabetes mellitus and hypertension (HTN), are a growing menace and public health problem. Optimal management of these diseases involves individuals adopting healthy lifestyle and complying with prescribed medications. **Aims and Objectives:** This study aims to assess the control rate, adherence to therapy and knowledge regarding risk factors, symptoms and complications of HTN and DM among hypertension and diabetes workers in a tea plantation in South India. **Materials and Methods:** A cross-sectional study was done among 203 plantation workers with prior diagnosis of diabetes and/or HTN. A structured pre-tested questionnaire was used to capture the sociodemographic details, knowledge of disease, and its complications and comorbidity status. Medication adherence rating scale (MARS) was administered to document adherence and worker's records were reviewed to assess the control of diabetes and/or HTN. **Results:** Among the 99 diabetics interviewed, 64 (64.6%) had good control of diabetes (having a random blood sugar value of <200 mg/dl) and 65 (48.8%) of the 135 hypertensives had good control of HTN (having a blood pressure reading of <140/90 mm of Hg). Majority of the participants, 92.1% had low awareness regarding risk factors and disease complications. The mean MARS score in this study was 9.01 ± 0.14 . **Conclusion:** The level of adherence to medications was found to be high despite low awareness regarding risk factors and complications which may have resulting in moderate disease control levels.

KEY WORDS: Adherence; Complications; Knowledge; Non-communicable Diseases; Plantation Workers; Risk Factors


INTRODUCTION

Diabetes mellitus (DM) and hypertension (HTN) have emerged as major medical and public health issues worldwide, and both are important risk factors for coronary artery disease, heart failure, and cerebrovascular disease.^[1,2] The global prevalence of diabetes among adults in 2017 was 8.8%^[3] and is projected to rise to 9.9% by 2045. According

to Joint National Committee 7th reports, there are 1 billion hypertensive individuals in the world. The World Health Organization reports that HTN is responsible for 62% of cerebrovascular disease and 49% of ischemic heart disease, with little variation by sex.^[4]

India has the largest number of adult diabetics in the world, with a prevalence of 3.8% in rural and 11.8% in urban areas.^[5] The prevalence of HTN in adults is 25% in urban areas and 10% in rural areas of India.^[6] Considerable variation in prevalence of HTN (20–59%) was seen among the studies from rural east India with higher prevalence seen among Assam tea plantation workers.^[7]

Adherence is defined as the extent to which the patient's behavior with regard to medications, dietary practices, and

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lifestyle changes corresponds with agreed recommendations from a health-care provider.^[8] Adherence is a multidimensional phenomenon determined by the interplay of five sets of factors, termed “dimensions” by the World Health Organization - social/economic factors, provider-patient/health-care system factors, condition-related factors, therapy-related factors, and patient-related factors.^[8]

Medication non-adherence is common in both these diseases and poor adherence is an important and most common cause for uncontrolled blood glucose and blood pressure levels and development of complications. Non-adherence is a serious problem and has many serious effects on overall treatment and prognosis of the illness. Non-adherence is not only to medications but also it extends to diet, exercises, behaviors, etc. It is dangerous and costly, as in many illnesses non-compliance may signal that patient and physician goals and priorities differ regarding the treatment and its schedule. The patients who are non-adherent are more severely ill at the point of readmission to hospital, have more frequent readmission, are more likely to be admitted compulsorily, and have longer in-patient's stay.^[9]

It is important to keep the blood sugar and blood pressure under control to prevent or delay the onset of complications and to improve quality of life. A meta-analysis revealed that only one-tenth of rural and one-fifth of urban Indian hypertensive population have their BP under control.^[10] According to an article, diabetes control in India is very poor with a mean hemoglobin A1c of 9.0%.^[11]

Adequate knowledge of diseases is the key component of patient care. Studies have shown that patients do not have the appropriate knowledge about non-communicable diseases (NCDs) such as HTN and DM and increasing their knowledge and awareness about such diseases have helped reduce morbidity and mortality.^[12,13] Poor awareness and practices are some of the important variables influencing the development and progression of the disease and its complications but are largely preventable.^[14] A study has also shown that increasing patient knowledge regarding disease and its complications have significant benefit with regard to patient compliance.^[15]

The adherence and control level of diseases mainly depend on the level of knowledge of patients about disease in depth. This, in turn, improves the lifestyle, thereby changing the disease pattern. We decided to do this study as plantations are most often a closed community with very good access to health-care facilities and services. The aim of the study was to assess the control levels, adherence to pharmacological therapy and knowledge regarding the risk factors, symptoms and complications of DM and HTN among hypertensive and diabetic plantation workers in south India.

MATERIALS AND METHODS

This cross-sectional study was undertaken among plantation workers in selected tea estates in South India who were diagnosed with DM and essential HTN or both and who were currently on treatment with a single or combination antidiabetic and antihypertensive drugs. Ethical clearance was taken from the Institutional Ethics Committee of St. John's Medical College. The sample size was calculated using the formula $n = z^2pq/d^2$, where, z - relative deviate (at 95% confidence interval), i.e., 1.96, P - prevalence of fully adherent patients to diabetes and HTN medication was 76%,^[16] and d = absolute precision (precision taken is 6%). The final sample size came up to 203. Calibrated mercury sphygmomanometer was used to record the blood pressure, stadiometer and calibrated dial weighing machine was used to document anthropometric measures and glucometer to document blood sugar.

The interview schedule was divided into four parts. The first part consisted of the sociodemographic details. The second part assessed the awareness level regarding DM and HTN. The schedule had a list of 14 items covering both modifiable and non-modifiable risk factors, 15 items related to symptoms of HTN, 10 items related to symptoms of diabetes, and six items related to complications. Correct answer was given a score of one, wrong answer was given a score of zero, and there was no negative scoring. The total maximum score was 44.

The third part of interview schedule was medication adherence rating scale (MARS)^[17] to determine the adherence to treatment among the subjects. There were 10 questions, related to forgetfulness, adherence during worse and good conditions and the effect felt by medications to the patient. The total score ranged from 0 to 10. Higher scores denote adherence to treatment.

The fourth part was regarding factors affecting medication adherence and assessed in five dimensions - socioeconomic related, patient related, therapy related, health-care system related, and condition related. The morbidities which affect adherence were also tested using Mini-Mental Status Examination,^[18] near vision test, whispered voice test for hearing, and Mini-CogTM.^[19]

The Mini-Mental State Examination or Folstein test was a 30-point questionnaire that is used extensively in clinical and research settings to measure cognitive impairment. A score <25 indicates requirement for formal psychometric assessment.^[18]

The Mini-CogTM was a simple screening tool which takes about 3 min to administer and used to detect dementia. A score of 3–5 of 5 is a negative screen for dementia.^[19] Whispered voice test was used to assess hearing^[20] and distant vision was tested using Snellen charts.

The data collected were entered into Microsoft Excel and analyzed using SPSS version 16. The demographic data were analyzed using frequencies, means, median, and standard deviations.

The awareness was categorized as high (>50% score), moderate (25–50% of the score), and low awareness (<25% of the score) for descriptive statistics. Awareness levels were taken as continuous variable for further analysis and appropriate statistical methods were used to find associations.

The MARS is used to determine the adherence to treatment among the study participants.

RESULTS

Among the 203 subjects, 151 (74.4%) belonged to the age group of 40–60 years with a mean age of 54.19 ± 9.88 years. Around half (50.2%) of the study sample were male. Majority 167 (82.2%) of study subjects were from nuclear family and 104 (51.2%) had attended school.

Majority of them had never used tobacco 156 (76.8%) or alcohol 155 (76.4%) in their lifetime. Majority 183 (90.14%) of study subjects had no family history of HTN or DM. Among the study participants, 68 (33.5%) were diagnosed to have diabetes, 104 (51.2%) were hypertensive, and 31 (15.3%) had both diabetes and HTN [Table 1].

Among the 99 diabetics interviewed, 64 (64.6%) had good control of diabetes (having a random blood sugar value of <200 mg/dl) and 65 (48.8%) of the 135 hypertensives had good control of HTN (having a blood pressure reading of <140/90 mm of Hg).

Among the study subjects, 62 (30.5%) reported some form of complications, of which peripheral neuropathy (28), cardiovascular (10), ophthalmic problems (14), and stroke (6) were the most common. Furthermore, 26 (26.3%) of total diabetics and 50 (36.5%) of total hypertensives had some form of complications, i.e., nearly half of the study subjects diagnosed with both HTN and diabetes had complications.

All the subjects were adherent to medication based on MARS except 98.5% were not clear about effect of medications on thought process. Table 2 showing assessment of adherence dimensions among workers.

Majority of the study subjects had normal vision (99%), hearing (99.5%), and normal cognitive abilities (97%) and were negative for dementia (99%) (Table 3).

Among the study subjects, 187 (92.1%) had low awareness and 16 (7.9%) had moderate awareness regarding the diseases. The median awareness value was 2 (interquartile range 1–4).

Table 1: Sociodemographic characteristics of study population

Variables	Category	Frequency (%)
Age (years)	<40	11 (5.4)
	40–59	151 (74.4)
	>60	41 (21.2)
Gender	Male	102 (50.2)
	Female	101 (49.8)
Type of family	Joint	4 (2)
	Nuclear	167 (82.2)
	Three generation	32 (15.8)
Education	No formal education	77(37.9)
	School education	104 (51.2)
	PUC	21 (10.4)
	College education	1 (0.5)
Occupation	Field laborer	114 (56.2)
	Homemaker	28 (13.8)
	Retired	14 (6.9)
	Others	47 (23.2)
History of tobacco usage	Never used	156 (76.8)
	Former use	32 (15.8)
	Current usage	15 (7.4)
History of alcohol usage	Never used	155 (76.4)
	Former use	25 (12.3)
	Current usage	23 (11.3)
Family history of hypertension or diabetes mellitus	Absent	183 (90.1)
	Present	20 (9.9)
Current diagnosis	Diabetes	68 (33.5)
	Hypertension	104 (51.2)
	Hypertension and diabetes	31 (15.3)
Regular medications	Yes	189 (93.1)
	No	14 (6.9)
BMI (kg/m ²)	<18.5	14 (6.9)
	18.5–24.9	139 (68.5)
	>25	50 (24.6)

BMI: Body mass index, PUC: Pre university college

In this study, we did Kruskal–Wallis and Mann–Whitney U-tests to find association between awareness score and variables. It was found that variables such as multiple types and frequency of medications, ability to read English, need of assistance in taking medications, busy with routine activities, fear of dependence on medications, and not depressed on taking medications were significantly associated with awareness. Patients with both HTN and diabetes, who used more than two types of medications with a frequency >2 times, had more awareness score.

There was no significant association between awareness score and age, gender, family type, education, occupation, family history of disease, duration of disease, tobacco, alcohol usage, and body mass index.

Table 2: Assessment of adherence dimensions

Adherence dimensions	Factors associated with non-adherence	Frequency (%)
Social and economic dimension	Inability to read English	169 (83.3)
	Need of assistance in taking medications	29 (14.3)
	Busy with routine activities	127 (62.6)
	Non-availability of medical store	0
	Non-availability of medications in nearby store	1 (0.5)
	Expensive medications	193 (95.1)
Health-care system dimension	Not understanding doctors language	3 (1.5)
	Regular change in medications	159 (78.3)
	Consequences of not taking medications not properly explained	18 (8.9)
	Non-awareness of need for regular medication	2 (1)
Therapy-related dimension	Non-frequent follow-up	3 (1.5)
	Multiple type of medication per day	29 (14.3)
	Frequency of medications >2 times a day	10 (4.9)
	Alteration of medicines by self	195 (96.1)
	Required special skills for administering medications	7 (3.4)
	Side effects of medications	198 (97.5)
Patient behavior related dimension	No alterations in lifestyle	192 (94.6)
	No knowledge about lifelong treatment	22 (10.8)
	Fear of adverse effects of medications	15 (7.4)
	Fear of dependence to medications	9 (4.4)
	Non-belief of improvement despite taking medications	2 (1)
Condition-related dimension	Alcohol usage or smoker	26 (12.8)
	Depressed to take medications	194 (95.6)

Table 3: Morbidities affecting adherence of diseases

Factors	Normal (%)	Impairment (%)
MMSE	201 (99)	2 (1)
Mini-Cog™	197 (97)	6 (3)
Hearing	201 (99)	2 (1)
Vision	202 (99.5)	1 (0.5)

MMSE: Mini-mental status examination

Multiple linear regression analysis was done to find further association among the significant variables.

Table 4 shows multiple linear regressions of awareness score and significant variables. Workers who had HTN and DM, those who have no belief of improvement and those who have ability to read English and those who were on multiple types of medications had higher awareness score.

There was no significant association between adherence score and other sociodemographic variables.

DISCUSSION

This study was done to assess the knowledge regarding the disease and adherence to pharmacological therapy among patients diagnosed with DM and/or HTN in a selected tea plantation in South India.

The most important finding from this study was that most of the participants knew the existence of these diseases, but on further probing, majority did not know any risk factor or symptom or complication of the diseases. Among the 203 subjects interviewed, 7.1% of the patients had a moderate awareness about the risk factors and the possible complications of their disease, 92.7% of the patients had low awareness about their disease which is less than a study done in a Bijapur^[21] hospital among diabetic patients, 27% were aware about risk factor, and 13–30% of the patients were aware about various complications and in a study done in Ludhiana^[22] among hypertensive patients coming to hospital, 54% had good knowledge, 30% had average knowledge about their disease condition. However, in this study, grades of awareness were not categorized individually. The lower awareness may be due to the fact that majority were field laborers with only school education.

In the Chennai urban, rural epidemiology study, the knowledge among diabetics regarding the risk factors and complications was found to be low and was attributed to patients not being educated adequately regarding the disease.^[23]

Awareness of disease was high among those who could read English, need assistance in taking medications and busy with routine activities, fear of dependence on medications, and not depressed on taking medications. This may be

Table 4: Multiple linear regression factors associated with awareness scores

Variable	Regression coefficient	95% confidence interval	P value
Diagnosis	0.64	0.03–1.32	0.04
No depression on taking medication	0.67	0.9–1.6	0.58
Fear of dependence on medications	1.21	1.31–3.72	0.35
Ability to read English	1.06	0.02–2.22	0.049
Need of assistance in taking medications	0.27	1.01–1.04	0.68
Busy with routine activities	0.49	0.43–1.42	0.29
Multiple type of medications	0.77	0.02–1.56	0.04
Frequency of medications	0.32	0.61–1.26	0.498

due to the fact that more awareness in terms of disease occurs in those who had multiple diseases and on multiple medications as they will be more diligent about details. This shows that the patients who know about disease, its severity and complications were vigilant and show increased concern about medications. Patients with both HTN and diabetes, who used more than two types of medications with a frequency >2 times, had more awareness. This was consistent with other studies.^[24-26]

In this study, plantation workers had a mean adherence rate of 9.01 ± 0.14 , whereas a similar study done among diabetes and HTN population tea estate workers, 76.3% were fully adherent to treatment, 19.5% moderately adherent, and 4.2% poorly adherent to treatment.^[16] Higher mean adherence value may be due to the availability and accessibility of health system and the close-knit population and the frequent follow-ups in the form of monthly or bimonthly outreach - NCD clinics.

In a study done in teaching hospital in Pune among hypertensive patients, medication adherence was significantly associated with age, family type, and experience of symptoms. In this study, 23.4% showed high adherence and 76.6% showed low adherence to treatment.^[27] In a study done in a hospital in Maharashtra among patients with Type II DM, nearly 41% had high adherence, 37% had medium adherence, and 22% had low adherence. Higher adherence was in males, those who were unemployed and who had primary education.^[28]

In this study, we did not get any association with adherence level; this may be due to the fact that most of the plantation workers belong to similar sociodemographic status.

Medication adherence score was low among those who had an impaired cognitive ability which is similar to many other studies.^[26,29-32] In this study, most patients had no vision and hearing problems that might decrease the potential of mistakes in taking medications and increased control. MARS was low among those who had an impaired cognitive ability due to the fact that medication adherence involves a complex interaction of memory and executive abilities which is lacking in those with cognitive impairment.

Strength and Limitation

The strength of the present study was that it was a community-based study where almost all patients in the plantation were enumerated. This study assessed all the dimensions that affect adherence and the factors associated with it. The study had its own limitations. The overall sample size was small (203) because only that many patients enrolled in the study. A subjective scale was used to estimate adherence, primarily because of the feasibility of the project. More objective scales, such as the pill count, could have been used.

CONCLUSION

The level of awareness was found to be low; however, the level of adherence to medications was found to be comparable to other studies. The presence of interviewer bias and study being hospital based can be a limitation for the study.

Chronic lifestyle diseases (diabetes, HTN, cardiovascular, neurological disorders, and cancer) form substantial health burden and can no more be ignored. Hence, efforts need to be made in the form of health awareness programs to create awareness about the risk factors, symptoms, and complications of these diseases so that they can continue practicing proper adherence and self-care to prevent the complications.

REFERENCES

1. Pradeepa R. The rising burden of diabetes and hypertension in Southeast Asian and African regions: Need for effective strategies for prevention and control in primary health care settings. *Int J Hypertens* 2013;2013:1-14.
2. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030. *Diabetes Care* 2004;27:1047-53.
3. Statista. Diabetics Percentage Worldwide 2017|Statistic; 2018. Available from: <https://www.statista.com/statistics/271464/percentage-of-diabetics-worldwide>. [Last accessed on 2018 Jul 15].
4. World Health Report 2002: Reducing Risks, Promoting Healthy Life. Geneva, Switzerland: World Health Organization; 2002. Available from: <http://www.who.int/whr/2002>. [Last accessed on 2018 July 14].

5. Narula AS. Chronic kidney disease: The looming threat. *Med J Armed Forces India* 2008;64:2-3.
6. Gupta R. Trends in hypertension epidemiology in India. *J Hum Hypertens* 2004;18:73-8.
7. Hazarika NC, Biswas D, Narain K, Kalita HC, Mahanta J. Hypertension and its risk factors in tea garden workers of Assam. *Natl Med J India* 2002;15:63-8.
8. World Health Organization. Adherence to Long Term Therapies-Evidence for action; 2003. p. 27. Available from: http://www.who.int/chronic_conditions/adherence_report/en/print.html. [Last accessed on 2018 July 14].
9. Billups SJ, Malone DC, Carter BL. The relationship between drug therapy noncompliance and patient characteristics, health-related quality of life, and health care costs. *Pharmacotherapy* 2000;20:941-9.
10. Anchala R, Kannuri NK, Pant H, Khan H, Franco OH, Di Angelantonio E, *et al.* Hypertension in India: A systematic review and meta-analysis of prevalence, awareness, and control of hypertension. *J Hypertens* 2014;32:1170-7.
11. Joshi SR. Diabetes care in India. *Ann Glob Health* 2015;81:830-8.
12. Qureshi NN, Hatcher J, Chaturvedi N, Jafar TH, Hypertension Research Group. Effect of general practitioner education on adherence to antihypertensive drugs: Cluster randomised controlled trial. *BMJ* 2007;335:1030.
13. Sengwana MJ, Puoane T. Knowledge, beliefs and attitudes of community health workers about hypertension in the Cape Peninsula, South Africa. *Curationis* 2004;27:65-71.
14. Bollu M, Nalluri KK, Prakash AS, Lohith MN, Venkataramarao N. Study of knowledge, attitude, and practice of general population of Guntur toward silent killer diseases: Hypertension and diabetes. *Asian J Pharm Clin Res* 2015;8:74-8.
15. Heisler M, Piette JD, Spencer M, Kieffer E, Vijan S. The relationship between knowledge of recent HbA1c values and diabetes care understanding and self-management. *Diabetes Care* 2005;28:816-22.
16. Navya C, Naveen R, Ashwini S, Manu A, Steve J, Pretesh RK, *et al.* Adherence to medication among patients with diabetes and hypertension in selected tea estates in South India. *J Int Med Sci Acad* 2015;28:16-8.
17. Thompson K, Kulkarni J, Sergejew AA. Reliability and validity of a new medication adherence rating scale (MARS) for the psychoses. *Schizophr Res* 2000;42:241-7.
18. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res* 1975;12:189-98.
19. Borson S, Scanlan JM, Watanabe J, Tu SP, Lessig M. Improving identification of cognitive impairment in primary care. *Int J Geriatr Psychiatry* 2006;21:349-55.
20. Macphee GJ, Crowther JA, McAlpine CH. A simple screening test for hearing impairment in elderly patients. *Age Ageing* 1988;17:347-51.
21. Raj CP, Angadi MM. Hospital-based KAP study on diabetes in Bijapur, Karnataka. *Indian J Med Spec* 2010;1:80-3.
22. Kaur K, Sharma SK, Jhaji H, Kaur G, Bajwa H. Knowledge and learning needs of hypertensive patients visiting OPD at DMC & H, Ludhiana. *Nursing and Midwifery Research*. 2007 Jan;3(1).p.27.
23. Mohan D, Raj D, Shanthirani CS, Datta M, Unwin NC, Kapur A, *et al.* Awareness and knowledge of diabetes in Chennai-the Chennai urban rural epidemiology study [CURES-9]. *J Assoc Physicians India* 2005;53:283-7.
24. Rao CR, Kamath VG, Shetty A, Kamath A. Treatment compliance among patients with hypertension and Type 2 diabetes mellitus in a coastal population of Southern India. *Int J Prev Med* 2014;5:992-8.
25. White F, Wang L, Jelinek HF. Management of hypertension in patients with diabetes mellitus. *Exp Clin Cardiol* 2010;15:5-8.
26. Sweileh WM, Aker O, Hamouz S. Rate of compliance among patients with diabetes mellitus and hypertension. *An-Najah Univ J Res (Nat Sci)* 2005;19:1-12.
27. Nagarkar AM, Gadhave SA, Sharma I, Choure A, Morisky D. Factors influencing medication adherence among hypertensive patients in a tertiary care hospital, Pune, Maharashtra. *Natl J Community Med* 2013;4:559-63.
28. Sajith MA, Pankaj M, Pawar AT, Modi AM, Sumariya RO. Medication adherence to antidiabetic therapy in patients with Type 2 diabetes mellitus. *Int J Pharm Pharm Sci* 2014;6:564-70.
29. Stilley CS, Bender CM, Dunbar-Jacob J, Sereika S, Ryan CM. The impact of cognitive function on medication management: Three studies. *Health Psychol* 2010;29:50-5.
30. Cho MH, Yun JM, Lee JE, Shin DW, Kim SH. Association between cognitive impairment and poor antihypertensive medication adherence in elderly hypertensive patients. *Epidemiology (Sunnyvale)* 2017;7:5.
31. Viji PC, Sreejith K, Sreelatha M. Association of medication adherence with cognitive status in patients with chronic kidney disease. *Int J Pharm Bio Sci* 2017;8:226-31.
32. Alosco ML, Spitznagel MB, van Dulmen M, Raz N, Cohen R, Sweet LH, *et al.* Cognitive function and treatment adherence in older adults with heart failure. *Psychosom Med* 2012;74:965-73.

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