Original Article

# Prevalence, awareness, treatment, and control of diabetes and hypertension among elderly persons in a rural area of Ballabgarh, Haryana

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## Abstract

**Background:** In India, from 1971 to 2011, the proportion of elderly population has increased from 5.3% to 8.6%. According to the National Sample Survey, 60th round (2004), out of every 1000 elderly persons living in rural India, 40 were estimated to be diabetic, and 36 were estimated to be hypertensive. The objective of the study was to find the prevalence of diabetes and hypertension in elderly persons in a rural area of Ballabgarh, Haryana, and to assess the awareness, treatment, and control among them. **Method:** A total of 420 persons aged 60 years and above were selected by simple random sampling. House-to-house visit was done. A pretested interview schedule was administered. Blood pressure was measured using digital blood pressure machine. Two milliliters of venous blood was collected in vials for HbA1c estimation. **Results:** Of the 420 participants, 386 were available for blood pressure measurement, and 374 were available for HbA1c estimation. The prevalence of diabetes was 21.7%, and that of hypertension was 50.3%. Among diabetics, 45.7% were aware, of which, 94.6% were treated, and among them, 34.3% had their blood sugar under control. Among hypertensives, 58.8% were aware, of which, 96.5% were treated, and of the treated participants, 24.5% had controlled blood pressure. **Conclusion:** The high prevalence, low awareness, and low proportion of controlled diseased population highlights the importance of strengthening primary care and improving awareness about diabetes and hypertension among elderly persons in rural areas.

**Keywords:** Awareness, control, diabetes, elderly, hypertension, prevalence

## Introduction

Globally, the pace of aging has become faster than earlier, leading to the growth of elderly population (≥60 years) from 12% in 2015 to an estimated 22% in 2050.[1] In India, from 1971 to 2011, the elderly population proportion has increased from 5.3% to 8.6%. According to 2011 census, there were about 104 million elderly Indians. Of these, 73.3 million were living in rural India.[2]

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**Received:** 25-11-2019 **Revised:** 24-12-2019
**Accepted:** 31-12-2019 **Published:** 28-02-2020

**Access this article online**
Quick Response Code:
Website: www.jfmpc.com
DOI: 10.4103/jfmpc.jfmpc_1057_19

The South-East Asia Region (SEAR) suffers from a double disease burden; that of communicable diseases that remain an important public health problem, as well as noncommunicable diseases that have emerged as one of the leading causes of death. According to the National Sample Survey, 60th round (2004), out of every 1000 elderly persons living in rural India, 40 were estimated to be diabetic and 36 were estimated to be hypertensive.[3] Hence, this study was undertaken to generate population-based data on diabetes and hypertension among elderly persons living in a rural area of India.

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**How to cite this article:** Gupta S, Kumar R, Kalaivani M, Nongkynrih B, Kant S, Gupta SK. Prevalence, awareness, treatment, and control of diabetes and hypertension among elderly persons in a rural area of Ballabgarh, Haryana. J Family Med Prim Care 2020;9:777-82.

Ballabgarh, Haryana, and to assess the awareness, treatment, and control of the disease among them.

## Materials and Methods

This study was conducted in villages that were covered under the Comprehensive Rural Health Services Project (CRHSP), Ballabgarh, Faridabad, Haryana, India. This comprised of a population of about 100,000 spread across 28 villages. A computerized Health Management Information System was in place, wherein information on every individual in this area was updated regularly. At the time of this study, there were 7470 elderly persons aged 60 years and above living in this area.

The sample size was calculated using a formula for a cross-sectional study. For hypertension, the prevalence was assumed to be 29%.[4] For diabetes, the prevalence was assumed to be 17.5%.[4] As the prevalence of diabetes was lower, this was taken to calculate the sample size. Assuming the absolute precision to be 4%, alpha to be 5%, the required sample size was calculated as 360. Using 5% correction for death and migration, and 10% correction for nonresponse, the final sample size was 420 elderly persons. Simple random sampling was used for selection of participants from the Health Management Information System. The data was collected in May and June 2018. A self-developed interview schedule was used for recording of demographic and anthropometric details. It was pretested in the community. Blood pressure was measured using digital blood pressure machine (Omron automatic blood pressure monitor, model: HEM-7120) and suitable sized cuff. The blood samples were analyzed for HbA1c level at the laboratory of CRHSP, Ballabgarh. Blood pressure machine and HbA1c auto-analyzer (Adams Arkray, Model HA-8180, Japan) were calibrated before initiation of data collection, and every fortnightly during data collection.

Data were collected by house-to-house visits. If a participant could not be contacted despite three home visits, s/he was considered as nonresponder. All participants were explained about the purpose of the visit and the procedure. The interview schedule was administered. Blood pressure was measured twice at an interval of 5 min, in sitting posture, resting against back support, feet touching the ground. Mean of the two readings was taken as the final blood pressure. It was ensured that the participant had not smoked or drank alcohol or undertaken physical exercise within the past half an hour. Two milliliters of venous blood was collected aseptically and kept in an EDTA-treated vial. The vials were kept in a polythene bag within a vaccine carrier having ice packs. The vials were transferred under cold chain to the laboratory at CRHSP, Ballabgarh, the same day for estimation of HbA1c. Printed reports for HbA1c were collected. All participants were provided their blood reports and blood pressure readings.

Diabetes was diagnosed when HbA1c was ≥6.5%.[5] Hypertension was diagnosed if systolic blood pressure was ≥140 mmHg, and/or diastolic blood pressure was ≥90 mmHg.[6] Previously diagnosed cases of diabetes and hypertension (as per documents or history of intake of drugs) were considered as diseased even if their current values remained within normal limits. Those who knew about their diseased status before the data collection period were considered as aware. Those who were on allopathic pharmacological treatment during data collection were considered as treated. An HbA1c <7% in known diabetics was taken as controlled diabetes.[7] In known hypertensives who did not have diabetes, systolic blood pressure <140 mmHg and diastolic blood pressure <90 mmHg, and in participants with diabetics, systolic blood pressure <130 mmHg and diastolic blood pressure <80 mmHg were considered to have controlled hypertension.[6] Isolated systolic hypertension was defined as systolic blood pressure ≥140 mmHg and diastolic blood pressure <90 mmHg.

Ethical clearance was obtained from AIIMS Ethics Committee, Dated 12 February 2018. The participants were provided with an information sheet in Hindi. Informed written consent was obtained from all participants. Participants requiring treatment were referred to the nearest health center.

Data were entered in Microsoft Excel 2010 and analyzed in STATA v. 12.00. Prevalence of outcome variables was reported as a proportion (*n*, %) with 95% confidence interval. Chi-square test was done for gender and age group variables. Awareness, treatment, and control were assessed by proportion (*n*, %) with 95% confidence interval. Chi-square test was applied, and *P* value <0.05 was considered as statistically significant.

## Results

Out of the sample of 420 elderly persons, 27 were found to be deceased or migrated. Of the remaining 393 participants, seven could not be contacted despite three house visits. Hence, blood pressure could be recorded in 386 participants, giving a response rate of 98.2%. Twelve participants refused to give blood samples for HbA1c estimation. Thus, 374 blood samples were available for estimation, giving a response rate of 95.2%.

Among the participants in whom blood pressure was measured, the mean age (SD) was 69.3 (7.4) years; it was 68.8 (7.7) years among men and 69.7 (7.2) years among women. The age group of 60–64 years had the largest proportion of participants (30.6%), followed by the age group of 65–69 years (28.8%) [Table 1].

Among the participants in whom HbA1c was estimated, the mean age (SD) was 69.2 (7.3) years; it was 68.7 (7.6) years among men and 69.6 (7.1) years among women. The age group 60–64 years had the largest proportion of participants (31.0%), followed by the age group of 65–69 years (29.1%) [Table 1].

Of 374 participants who gave blood sample for HbA1c estimation, 81 (21.7%, 95% CI: 17.5–25.9) were diabetic. Of 157 men, 26 (16.6%, 95% CI: 10.7–22.4), and of 217 women, 55 (25.3%, 95% CI: 19.5–31.2) were diabetic [Table 2]. After

**Table 1: Demographic characteristics of participants**

| Variables | Blood pressure measured | | | Blood HbA1c estimated | | |
|---|---|---|---|---|---|---|
| | Men *n*=161 (%) | Women *n*=225 (%) | Total *n*=386 (%) | Men *n*=157 (%) | Women *n*=217 (%) | Total *n*=374 (%) |
| Age groups (in years) | | | | | | |
| 60-64 | 59 (36.7) | 59 (26.2) | 118 (30.6) | 58 (36.9) | 58 (27.7) | 116 (31.0) |
| 65-69 | 40 (24.8) | 71 (31.6) | 111 (28.8) | 40 (25.5) | 69 (31.8) | 109 (29.1) |
| 70-74 | 31 (19.3) | 40 (17.8) | 71 (18.4) | 30 (19.1) | 38 (17.5) | 68 (18.2) |
| ≥75 | 31 (19.3) | 55 (24.4) | 86 (22.3) | 29 (18.5) | 52 (24.0) | 81 (21.7) |

**Table 2: Prevalence of diabetes among participants**

| Demographic variables | Diabetes | |
|---|---|---|
| | *n* | Prevalence (95% CI) |
| Total | 374 | 21.7 (17.5-25.9) |
| Gender | | |
| Men | 157 | 16.6 (10.7-22.4) |
| Women | 217 | 25.3 (19.5-31.2) |
| Chi-square *P* | | 0.042 |
| Age-group (years) | | |
| 60-64 | 116 | 18.1 (11.0-25.2) |
| 65-69 | 109 | 25.7 (17.4-34.0) |
| 70-74 | 68 | 19.1 (9.5-28.7) |
| ≥75 | 81 | 23.5 (14.0-32.9) |
| Chi-square *P* | | 0.509 |

adjustment for age, the prevalence of diabetes was 21.7% (15.9% in men and 24.7% in women).

Of the 81 participants with diabetes, 45.7% were aware of their disease condition; 94.6% of these were undergoing treatment, of which, 34.3% had their diabetes under control. An almost equal proportion of men and women were aware, under treatment, and had controlled diabetes. Awareness and treatment were found to be maximum in the age group ≥75 years. The higher proportion of participants of age group 70–74 years had diabetes under control. However, the number of participants in this age-group was small. *P* value for Chi-square test was statistically nonsignificant among the genders and across age-groups [Table 3].

Of the 386 participants in whom blood pressure was measured, 194 (50.3%, 95% CI: 45.2–55.2) were hypertensive. Out of 161 men, 74 (46.0%, 95% CI: 38.1–53.7) and out of 225 women, 120 (53.3%, 95% CI: 46.8–59.9) were hypertensive. Isolated systolic hypertension was present in 58 (15.0%, 95% CI: 11.4–18.6) participants. Among men, 23 (14.3%, 95% CI: 8.8–19.7) had isolated systolic hypertension. Among women, 35 (15.6%, 95% CI: 10.8–20.3) had isolated systolic hypertension [Table 4]. After adjustment for age, the prevalence of hypertension was 50.7% (45.7% in men and 53.3% in women).

Of 194 hypertensive participants, 58.8% were aware of their disease condition; of these, 96.5% were on treatment, of which, 24.5% had their blood pressure under control. A higher proportion of women (64.2%) were aware than men (50.0%); a higher proportion of women (98.7%) were under treatment than men (91.9%). The highest proportion of participants of the age group 65–69 years (69.2%) were aware. In the age group ≥75 years, all aware participants were taking treatment; of these, 44% (highest among all age groups) had their blood pressure under control. The difference between the two genders and across all age-groups was statistically nonsignificant [Table 5].

## Discussion

We estimated the prevalence of diabetes among the elderly population residing in a rural area in Haryana to be 21.7%. The prevalence was 16.6% in men, and 25.3% in women. HbA1c estimation was used for the diagnosis of diabetes.

In the study by Radhakrishnan *et al.*, the prevalence of diabetes in a rural community of Tamil Nadu was 17.5% (22% in men and 15% in women). In this study, random glucose estimation was done.[4] The diagnostic method and difference in the population may have caused the difference in outcome. Random glucose estimation is prone to be affected by recent intake of glucose, whereas HbA1c provides information on glycemic status over a fairly long period, and is less likely to get affected by recent intake. Therefore, our findings are more robust.

In the Indian studies by Goswami *et al.* in 2016, and Singh *et al.* in 2012, where the urban population was included, the prevalence of diabetes was found to be 18.8% and 24%, respectively. The values are similar to our study. Both the studies were conducted in Delhi and used fasting blood glucose for diagnosis of diabetes.[8,9] Due to physical proximity of the geographical location to our study area, lifestyle of population was similar. This explains the similar prevalence. The findings also suggest that conventional rural-urban differences may be narrowing.

In the studies conducted abroad, the prevalence of diabetes ranged from 13.8% to 34.4%. In the study from Italy by Limongi *et al.*, fasting blood glucose ≥140 mg/dl or self-reported history was used as diagnostic criteria. The prevalence was 13.8%, lower than our study. The higher cut-off (fasting blood glucose ≥126 mg/dl is considered as diabetes) may be responsible for the lower prevalence. In addition, persons only up to 84 years of age were enrolled, unlike our study, where there was no upper limit of age.[10] In the study from Malaysia by Ho *et al.*, fasting capillary glucose was checked, and prevalence was 34.4%. Cut-off taken was 110 mg/dl. The high prevalence may be explained by the lower diagnostic cut-off.[11] In the study by Tyrovolas *et al.*

**Table 3: Awareness, treatment, and control status among diabetic participants**

| Demographic variables | Aware *n* (%) | Treated *n* (%) | Controlled *n* (%) |
|---|---|---|---|
| Total (*n*=81) | 37 (45.7) | 35 (94.6) | 12 (34.3) |
| Gender | | | |
| Men (*n*=26) | 11 (42.3) | 11 (100.0) | 4 (36.4) |
| Women (*n*=55) | 26 (47.3) | 24 (92.3) | 8 (33.3) |
| *P* (Chi-square) | 0.675 | 0.910 | 1.00 |
| Age group (years) | | | |
| 60-64 (*n*=21) | 10 (47.6) | 10 (100.0) | 4 (40.0) |
| 65-69 (*n*=28) | 10 (35.7) | 9 (90.0) | 2 (22.2) |
| 70-74 (*n*=13) | 5 (38.5) | 4 (80.0) | 3 (75.0) |
| ≥75 (*n*=19) | 12 (63.2) | 12 (100.0) | 3 (25.0) |
| *P* (Chi-square for trend) | 0.288 | 0.987 | 0.447 |

**Table 4: Prevalence of hypertension and isolated systolic hypertension among participants**

| Demographic variables | Hypertension | | Isolated systolic hypertension |
|---|---|---|---|
| | *n* | Prevalence (95%CI) | Prevalence (95% CI) |
| Total | 386 | 50.3 (45.2-55.2) | 15.0 (11.4-18.6) |
| Gender | | | |
| Men | 161 | 46.0 (38.1-53.7) | 14.3 (8.8-19.7) |
| Women | 225 | 53.3 (46.8-59.9) | 15.6 (10.8-20.3) |
| Chi-square *P* | | 0.153 | 0.731 |
| Age-group (years) | | | |
| 60-64 | 118 | 45.8 (36.6-54.9) | 9.3 (4.0-14.6) |
| 65-69 | 111 | 46.8 (37.4-56.3) | 10.8 (4.9-16.7) |
| 70-74 | 71 | 53.5 (41.6-65.4) | 19.7 (10.2-29.2) |
| ≥75 | 86 | 58.1 (47.5-68.8) | 24.4 (15.2-33.7) |
| Chi-square *P* | | 0.271 | 0.008 |

**Table 5: Awareness, treatment, and control status among hypertensive participants**

| Demographic variables | Aware *n* (%) | Treated *n* (%) | Controlled *n* (%) |
|---|---|---|---|
| Total (*n*=194) | 114 (58.8) | 110 (96.5) | 27 (24.5) |
| Gender | | | |
| Men (*n*=74) | 37 (50.0) | 34 (91.9) | 9 (26.5) |
| Women (*n*=120) | 77 (64.2) | 76 (98.7) | 18 (23.7) |
| *P* (Chi-square) | 0.052 | 0.100 | 0.462 |
| Age group (years) | | | |
| 60-64 (*n*=54) | 30 (55.6) | 28 (93.3) | 5 (17.9) |
| 65-69 (*n*=52) | 36 (69.2) | 35 (97.2) | 9 (25.7) |
| 70-74 (*n*=38) | 23 (60.5) | 22 (95.7) | 6 (27.3) |
| ≥75 (*n*=50) | 25 (50.0) | 25 (100.0) | 11 (44.0) |
| *P* (Chi-square for trend) | 0.548 | 0.246 | 0.103 |

from the Mediterranean Islands, fasting blood glucose level ≥125 mg/dl was taken for diagnosis. The reported prevalence was similar to our study.[12] In the study conducted by Porapakkham *et al.* in Thailand, venous fasting glucose after at least 12 h of fasting was obtained.[13] The study from the U.S. by Cowie *et al.* reports prevalence from the NHANES, where diabetes was diagnosed by plasma glucose study after overnight fasting.[14] Selvin *et al.* reported a prevalence of diabetes in the U.S. as 15.3%. They used fasting blood glucose (≥126 mg/dl) and self-reporting by the participants.[15] The difference in methodology, diagnostic test, and population accounts for the difference in outcome.

In our study, of the 81 participants with diabetes, 45.7% were aware of their disease condition; of these, 94.6% were under treatment, of which, 34.3% had their diabetes under control. The Indian studies, conducted in urban Delhi slums, showed varying results. In the study by Goswami *et al.*, 62.3% of the prevalent cases were treated, and 33.6% of the treated cases were under control.[8] In the study by Singh *et al.*, 35.9% of prevalent cases was aware, 62.5% of the aware population were treated, and 75% of those treated had glycemic status under control.[9] The treatment of diabetes is complex and is generally expensive. This affects compliance. Therefore, some rural-urban differences in treatment could be anticipated. In the studies undertaken abroad, the proportion of awareness varied from 15.3% to 65.2%.The proportion of control ranged from 21.8% to 26.4% among the population who were treated.[11,13,15]

In our study, the prevalence of hypertension was 50.3% (46% in men and 53.3% in women).

In studies conducted in rural India, the prevalence varied between 29% to 46% in the studies by Radhakrishnan *et al.*, Joshi *et al.*, and Chinnakali *et al.*[4,16,17] In the study by Joshi *et al.*, three readings of blood pressure were recorded at an interval of 3 min each.

In the Indian studies, where the urban population was added, the prevalence obtained was higher than that of our study. It varied between 39.5% and 67%. The difference in prevalence is explained by the nature of population being urban. In the study by Goswami *et al.*, two readings of blood pressure were recorded at 5 min interval where digital blood pressure monitoring device was used.[8] In the study conducted by Yadav *et al.*, blood pressure was reported in two visits, one week apart. Hence, the lower prevalence can be explained by ruling out false high readings, obtained at first visit.[18] In the study by Chaturvedi *et al.*, mercury sphygmomanometer was used.[19]

In the studies undertaken abroad, the prevalence of hypertension varied greatly from 25.6% to 86.8%. The studies by Porapakkham *et al.*, Sheng *et al.*, Hammami *et al.*, Rashid *et al.*, and Lai *et al.* showed similar prevalence.[13,20-23] The study by Nunes *et al.* reported a high prevalence, 86.8%. Here, digital blood pressure machine was used, and two readings were taken at 20 min interval.[24] Srinivas *et al.* reported the prevalence of hypertension to be 25.6%. This can be due to the high cut-off criteria of ≥160/95 mmHg that was considered in the study.[25]

In the present study, of 194 hypertensive participants, 58.8% were aware; of these, 96.5% were receiving treatment, of which, 24.5% had their blood pressure under control. In Indian studies, the reported proportion of awareness in hypertensive persons ranges between 22.2% and 62% of the diseased population. The proportion of those with control of hypertension varied from 13.5% to 32%. The studies conducted by Goswami *et al.*, Yadav *et al.*, Chaturvedi *et al.*, Kalavathy *et al.*, and Swami *et al.* included population from urban areas, which explains the difference in proportions when compared to our study in rural India.[8,18,19,26,27] In the study undertaken in rural areas of India by Joshi *et al.*, awareness was present in 22.2% of the hypertensive population.[16] In the study by Chinnakali *et al.*, awareness was present in 62% of the diseased population, 98% of whom were treated and among the treated, 13.5% had disease under control.[17] The findings were similar to our study.

In the studies conducted abroad, the percentage of people who were aware of their hypertensive status was between 24.1% and 81.8%. The proportion of treated population among the aware population was ranged from 36.1% to 82.1%. The percentage of controlled disease varied between 10.6% and 50.7% of the treated population.[13,20-22,25,28-33] Many studies reported a similar proportion of controlled disease among the treated population like our study.[16,20,26,34-36]

The present study found a high burden of diabetes and hypertension among elderly persons in the community. The awareness of the conditions was low, viz., less than half in the diabetes group, and slightly more than half in the hypertensive group. Further, among those taking treatment, control of both conditions was found to be poor. At the primary care level, screening for these conditions among asymptomatic persons shall be useful in their early diagnosis and management. Appropriate counseling to improve adherence to treatment and advice is likely to result in better control of these conditions.

The family physicians are usually contacted by patients for the management of their chronic diseases, including diabetes and hypertension. They play an important role in the control of such diseases and the prevention of complications. Being the first doctor to be contacted, the family physician is in a good position to diagnose early diabetes and hypertension, which are often asymptomatic, and patients are not aware that they have this condition. Detection of chronic illnesses at the earliest, control of such diseases, and prevention of complications will lead to improved quality of life of the patient. Family physicians can explain the chronic nature of the disease and importance of compliance to medication in these diseases.

This was a community-based study among elderly persons in a rural area, with a high response rate. HbA1c was used for the diagnosis of diabetes. Temporality with associated factors cannot be established due to the cross-sectional nature of the study. Generalizability of the study is limited to rural area only.

## Conclusion

It was observed that the prevalence of both diabetes and hypertension was high among the rural elderly population. Awareness about the disease status was low among the diseased. Although high proportion of known diabetics and hypertensives were on treatment, control was poor among them. This highlights the necessity of strengthening primary care and generation of awareness regarding noncommunicable diseases.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

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