# Assessment of selenium levels and risk factors for stroke and other cardiovascular disease: a cross sectional study in a seleniferous area of Punjab, India

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## Introduction

Rural areas of Punjab in India have been found to have soil rich in selenium (Se); about 2160 hectare area is seleniferous and is populated by about 10,000 inhabitants (Figure 1). Selenium concentrations in these villages were reported to be as high as 65 times over non-seleniferous areas. The aim of this cross-sectional study was to evaluate selenium levels in blood, hair and nails in a group of subjects living in this area, and to evaluate the correlation between selenium exposure levels and a relevant cardiovascular risk factor and blood pressure.
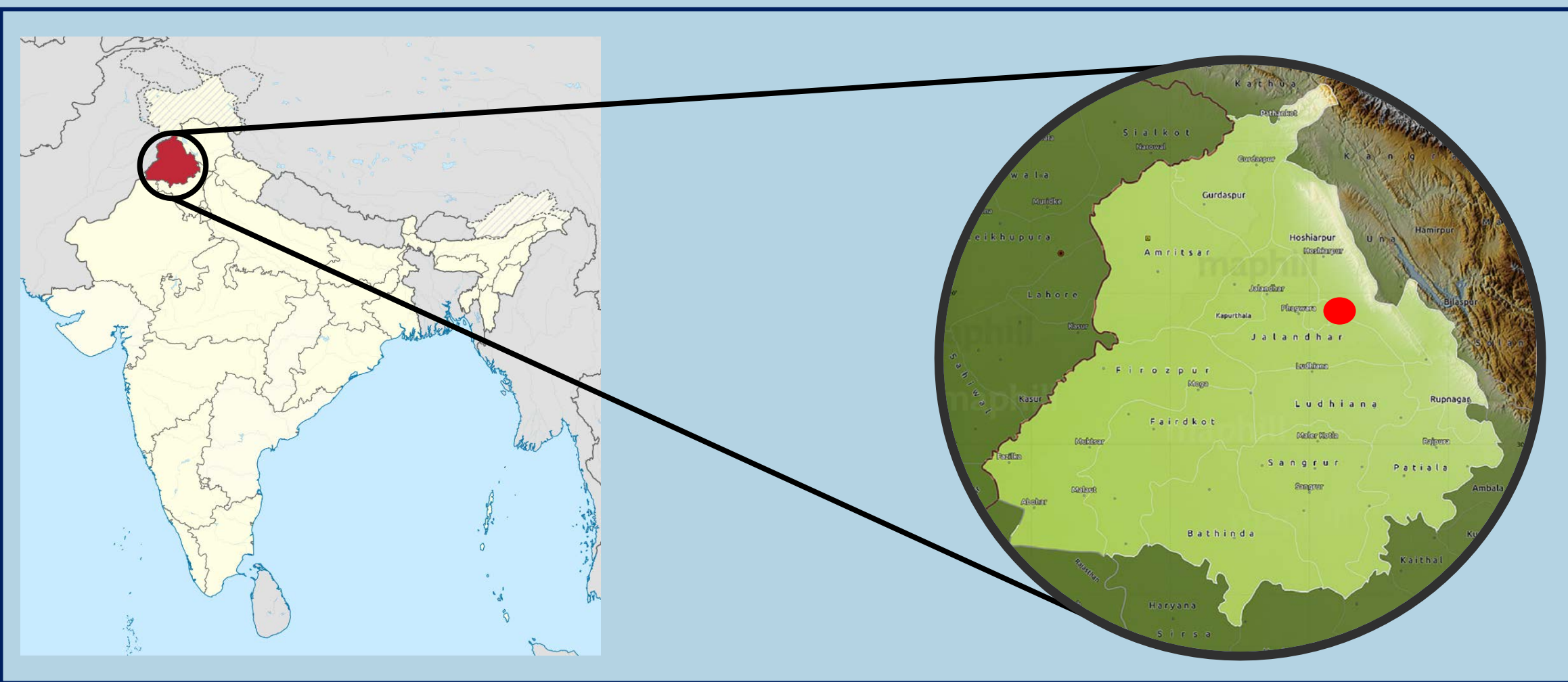


**Figure 1:** Rural areas of Punjab, India.

## Methods

In a random sample of rural residents in three districts of a seleniferous area of Punjab, we determined selenium concentration in hair, nail clippings and serum samples. Analyses were carried out using atomic absorption spectrophotometry at National Dairy Research Institute (NDRI), Karnal, India. Data analysis was performed using the STATA 15.0 software (STATA Corp.TX).

## Results

A total of 680 human subjects were recruited in this study, with a male/female ratio of 0.65 and a median age of 43 (Interquartile Range: IQR 32-52) (Table 1). Medium selenium levels in blood, hair and nail were 86.7 µg/l (IQR 55.9-200.3), 20.7 µg/g (IQR 12.6-40.3) and 56.9 µg/g (IQR 42.8-83.9), respectively, with lower levels in women in all three kind of samples. Concerning systolic blood pressure, Pearson's correlation coefficients were 0.102 (95 % CI -0.025 to 0.226, p=0.116); 0.076 (95% CI -0.010 to 0.160, p=0.085); 0.072 (95% CI -0.015 to 0.157, p=0.104) with blood, hair and nail, respectively. For diastolic blood pressure, Pearson's correlation coefficients are 0.106 (95% CI -0.022 to 0.230, p=0.104), 0.036 (95% CI -0.050 to 0.122, p=0.409), 0.049 (95% CI -0.038 to 0.135, p=0.272), respectively (Table 2).

| | All N=680 | Men N=267 | Women N=413 |
|---|---|---|---|
| | N (%) | 50th IQR | 50th IQR |
| *Age[a]* | 43 (32-52) | 45 (30-54) | 42 (34-50) |
| *Age categories* | | | |
| <30 | 133 (19.6) | 63 (23.6) | 70 (17.0) |
| 30-39 | 135 (19.8) | 47 (17.6) | 88 (21.3) |
| 40-49 | 183 (26.9) | 56 (21.0) | 127 (30.7) |
| 50-59 | 177 (26.0) | 71 (26.6) | 106 (25.7) |
| >60 | 52 (7.7) | 30 (11.2) | 22 (5.3) |
| *Village* | | | |
| Baghauran | 56 (8.2) | 30 (11.2) | 26 (6.3) |
| Barwa | 158 (23.2) | 57 (21.4) | 101 (24.4) |
| Jaadli | 101 (14.9) | 39 (14.6) | 62 (15.0) |
| Mehind Pur | 126 (18.5) | 41 (15.4) | 85 (20.6) |
| Nazar Pur | 43 (6.3) | 19 (7.1) | 24 (5.8) |
| Rakra Dhaha | 55 (8.1) | 20 (7.5) | 35 (8.5) |
| Simbly | 141 (20.7) | 61 (22.8) | 80 (19.4) |
| *Caste* | | | |
| Lower caste | 413 (60.8) | 157 (58.8) | 256 (62.0) |
| Artisan | 5 (0.7) | 2 (0.8) | 3 (0.7) |
| Upper caste | 262 (38.5) | 108 (40.4) | 154 (37.3) |
| *Occupation* | | | |
| Labourer | | 100 (37.5) | - |
| Service | | 30 (11.2) | - |
| Business | | 24 (9.0) | - |
| Cultivator | | 113 (42.3) | - |
| Serving outside for money | | - | 20 (4.8) |
| Working at home | | - | 354 (85.7) |
| Not reported | | - | 39 (9.4) |
| *Education* | | | |
| No schooling/NR | 157 (23.1) | 35 (13.1) | 122 (29.5) |
| Below Matric | 269 (39.6) | 100 (37.5) | 169 (40.9) |
| Matric | 149 (21.9) | 73 (27.3) | 76 (18.4) |
| Above Matric | 105 (15.4) | 59 (22.1) | 46 (11.1) |
| *Comorbidities* | | | |
| Not in list | 553 (81.3) | 219 (82.0) | 334 (80.8) |
| Diabetes | 21 (3.1) | 9 (3.4) | 12 (2.9) |
| Hypertension | 100 (14.7) | 37 (13.9) | 63 (15.3) |
| Tuberculosis | 6 (0.9) | 2 (0.7) | 4 (1.0) |
| *Drinking water facilities* | | | |
| Hand pump | 237 (34.9) | 99 (37.1) | 138 (33.4) |
| Piped | 443 (65.1) | 168 (62.9) | 275 (66.6) |

**Table 1:** Characteristics pf study participants

| | Systolic Blood Pressure | | | Diastolic Blood Pressure | | |
|---|---|---|---|---|---|---|
| | r | 95% CI | P | r | 95% CI | P |
| **All** | | | | | | |
| **Se blood (N=238)** | 0.102 | (-0.025 to 0.226) | *0.116* | 0.106 | (-0.022 to 0.230) | *0.104* |
| **Se hair (N=521)** | 0.076 | (-0.010 to 0.160) | *0.085* | 0.036 | (-0.050 to 0.122) | *0.409* |
| **Se nail (N=513)** | 0.072 | (-0.015 to 0.157) | *0.104* | 0.049 | (-0.038 to 0.135) | *0.272* |
| **Men** | | | | | | |
| **Se blood (N=107)** | -0.022 | (-0.211 to 0.169) | *0.826* | -0.002 | (-0.192 to 0.188) | *0.983* |
| **Se hair (N=187)** | 0.037 | (-0.107 to 0.180) | *0.612* | 0.019 | (-0.125 to 0.162) | *0.800* |
| **Se nail (N=182)** | -0.014 | (-0.160 to 0.131) | *0.846* | -0.017 | (-0.162 to 0.128) | *0.817* |
| **Women** | | | | | | |
| **Se blood (N=131)** | 0.170 | (-0.002 to 0.332) | *0.052* | 0.164 | (-0.007 to 0.327) | *0.061* |
| **Se hair (N=334)** | 0.103 | (-0.004 to 0.208) | *0.060* | 0.052 | (-0.055 to 0.159) | *0.339* |
| **Se nail (N=331)** | 0.073 | (-0.005 to 0.209) | *0.061* | 0.073 | (-0.035 to 0.179) | *0.187* |

**Table 2:** Blood pressure Pearson's correlation

## Conclusions

Our findings indicate a positive correlation between selenium content in blood, hair and nails and increasing systolic and diastolic pressure levels, in line with previous epidemiologic findings, indicating a possible health concern for this highly exposed population. The possible relation between selenium over-exposure and onset of hypertension and other cardiovascular diseases deserves further investigation.

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