

Investigating The Risk Factors for Hypertension in A Population-Based Study: Fasa PERSIAN COHORT Data

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Abstract

Background: High prevalence of hypertension (HTN) and its subsequent serious complications make this disease as a major health-treatment concern in many societies. The current study aimed to investigate known factors as risk factors for hypertension and the way of their association in study population of Fasa cohort in south of Iran at 2019.

Methods: This is an analytical-cross sectional study. Study population was the individuals covered by Fasa cohort. Information of the first phase of Fasa Persian cohort in south of Iran was used in the study. Independent t-test, chi-square test, analysis of variances, Pearson correlation coefficient, and logistic regression were used to analyze data. Data was analyzed using SPSS software version 22, and P-value<0.05 was considered statistically significant.

Results: Out of the population of 10111 individuals of the study, 5546(54.86%) subjects were female and 4565(45.16%) were male. The overall prevalence of hypertension was 41.8 %. In the present study (28/5%) were with HTN stage 1, and (13/3%), were with HTN stage 2. In addition, a significant association was observed among HTN and cardiovascular diseases, diabetes and renal failure ($p<0.5$).

Conclusions: prevalence of HTN in study population is considerable. Given its hazardous complications, application of appropriate methods in order to screen, prevent and treat HTN is necessary. In addition, using training programs, changing lifestyle, and promoting self-care behaviors can be effective in prevention, control, and decrease in hazardous complications caused by HTN.

Background

High prevalence of hypertension (HTN) and its subsequent serious complications make this complication as a major problem of health system in many societies [1]. HTN as a silent assassin is the most prevalent and the most important reason of brain stroke, cardiovascular disease, heart failure and renal failure [2]. HTN is the reason for 54% of deaths caused by brain stroke, and 45% of deaths caused by cardiovascular diseases [3]. The World Health Organization introduced HTN as the third leading cause of death in the world, with one in eight deaths due to high blood pressure [4].

According to the opinion of American society of Hypertension (ASH) and International society of Hypertension (ISH), systolic blood pressure equal and greater than 140 mmHg and diastolic blood pressure equal and greater than 90 mmHg are named as HTN based on an average value obtained from at least twice accurate measurement of blood pressure [5]. The results of the study by Liew (2019) showed that prevalence of HTN varies based on demographic, cultural, and social factors in various societies, and hence, it is necessary that more comprehensive studies especially as cohort studies to be performed in various regions [6]. According to the reports by WHO at 2018, about 40% of individuals aged 25 years and higher had HTN [7].

In eastern Mediterranean countries and Middle East, prevalence of HTN in various assessments was reported as 17–39%, and rapid social and economic changes of these countries in recent decades leads to high prevalence of the HTN [8]. The results of the study conducted in Iran reported prevalence of HTN in age group of 15–65 years as 39.4% [9]. In Golestan province, according to the results of the cohort study, prevalence of HTN was reported as 41.8% [10]. In another study, prevalence of HTN in urban society of Golestan was reported as 32% and as 25% in Gorgan province [11].

Since HTN is considerably prevalent in most communities, and its prevalence in various regions varies based on demographic, cultural and social factors, and since there is no study based on the results obtained from cohort data in Iran to date, and besides, identification of risk factors in HTN will have important role in programming to better prevent, control and treat of this complication. Therefore, due to the importance of this issue, this study aimed to investigate known factors as risk factors for HTN, and the way of their association in study population of the Fasa Cohort in south of Iran.

Methods

The current study is an analytical-cross-sectional study. Study population was the individuals covered by Fasa Cohort in south of Iran [12].

Data of the first phase of cohort was use in this study. Sampling was not done and all the participants entered the study through census. In order to gather data, one questionnaire consisting demographic data and risk factors of HTN was used.

In addition, anthropometric indices (measurement of height-weight and waist circumference) and also blood pressure was used. In order to measure blood pressure, the average of twice measurement of blood pressure was considered as the criterion for blood pressure. In

order to classify blood pressure, JNC-8 index was used [13]. Accordingly, systolic blood pressure less than 120 mmHg and diastolic blood pressure less than 80 mmHg were considered as normal blood pressure, systolic blood pressure of 120-139 mmHg and diastolic blood pressure of 80-90 mmHg were considered as pre-hypertension, systolic blood pressure of 140-159 mmHg and diastolic blood pressure of 90-99 mmHg were considered as stage 1 HTN, systolic blood pressure equal and greater than 160 mmHg and diastolic blood pressure equal and greater than 100 mmHg were considered as stage 2 HTN.

Ethical considerations

All participants gave written informed consent to participate in the study. The present study was conducted in accordance with the principles of the revised Declaration of Helsinki, a statement of ethical principles which directs physicians and other participants in medical research involving human subjects. The participants were assured of their anonymity and confidentiality of their information. Moreover, the study was approved by the local Ethics Committee of Fasa University of Medical Sciences, Fasa, Iran (IR.FUMS.REC.1398.063).

Results

Out of 10111 participants, 5546 (54.86%) were female and 4565 (45.14%) were male. The mean of systolic and diastolic blood pressure were 111.36 ± 18.51 and 74.65 ± 11.99 respectively (Table 1). The overall prevalence of hypertension was 41.8%. In the present study (28/5%) were with HTN stage 1, and (13/3%), were with HTN stage 2 (Table 2,3). Table 4,5 shows the associated factors of hypertension. Age, BMI, Hipcircumference, HDL, TG, BUN, ALP(Alkaline phosphatase), Smoking, Physical activity Diabetes, Cardiac ischemic, Renal Failure and Breast feeding were significantly associated with the hypertension status of the study subjects ($P < 0.05$). Independent t-test, chi-square test, analysis of variances, Pearson correlation coefficient, and logistic regression were used to analyze data. Data was analyzed using SPSS software version 22, and $P < 0.05$ was considered statistically significant.

Table 1
Mean systolic and diastolic blood pressure (mm hg) by age and gender.

| Age groups (years) | | Systolic BP (mean \pm SD) | | | Diastolic BP (mean \pm SD) | | |
|--------------------|-------|-------------------------------------------|-------------------------------------------|-------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|
| Age | N | Male | Female | total | Male | Female | total |
| 35-44 | 4020 | 105.24 \pm 13.25 | 104.89 \pm 14.83 | 105.05 \pm 14.13 | 72.47 \pm 10.82 | 72.12 \pm 11.36 | 72.28 \pm 11.11 |
| 45-54 | 3154 | 109.20 \pm 16.53 | 112.75 \pm 18.41 | 111.20 \pm 17.70 | 74.11 \pm 11.96 | 75.68 \pm 12.18 | 74.99 \pm 12.11 |
| 55-64 | 2329 | 118.08 \pm 20.17 | 119.97 \pm 21.05 | 119.08 \pm 20.66 | 76.97 \pm 12.63 | 77.58 \pm 12.33 | 77.29 \pm 12.47 |
| 65-74 | 569 | 122.37 \pm 19.81 | 124.47 \pm 22.04 | 123.65 \pm 21.20 | 78.04 \pm 11.76 | 78.34 \pm 11.92 | 78.22 \pm 11.85 |
| Over 75 | 39 | 133.07 \pm 22.49 | 136.00 \pm 19.69 | 133.82 \pm 21.59 | 79.48 \pm 13.45 | 83.01 \pm 11.52 | 80.38 \pm 12.94 |
| Total | 10111 | 110.52 \pm 17.56 | 112.05 \pm 19.22 | 111.36 \pm 18.51 | 74.36 \pm 11.84 | 74.88 \pm 12.11 | 74.65 \pm 11.99 |
| P- Value | | F = 148.60 df = 4 P= \times 0.001 | F = 191.66 df = 4 P= \times 0.001 | F = 334.31 df = 4 P= \times 0.001 | F = 32.78 df = 4 P= \times 0.001 | F = 55.81 df = 4 P= \times 0.001 | F = 85.75 df = 4 P= \times 0.001 |

Table 2
Prevalence systolic of hypertension by gender and age groups among the study subjects.

| Age groups (years) | | Male | | | | Female | | | |
|--------------------|-------|------------------------------------------|-----------------|-------------|-------------|------------------------------------------|-----------------|-------------|-------------|
| Age | N | Normal | Prehypertension | Stage 1 HTN | Stage 2 HTN | Normal | Prehypertension | Stage 1 HTN | Stage 2 HTN |
| 35–44 | 4020 | 1539 (83.5) | 269(14.6) | 31(1.7) | 4(0.2) | 1799(82.6) | 310(14.2) | 62(2.8) | 6(0.3) |
| 45–54 | 3154 | 1013(73.6) | 278(20.2) | 74(5.45) | 12(0.9) | 1164(65.5) | 430(24.2) | 138(7.8) | 45(2.5) |
| 55–64 | 2329 | 585(53.5) | 335(30.6) | 129(11.8) | 45(4.1) | 628(50.9) | 380(30.8) | 158(12.8) | 69(5.6) |
| 65–74 | 569 | 93(41.9) | 85(38.3) | 32(14.4) | 12(5.4) | 145(41.8) | 116(33.4) | 52(15) | 34(9.8) |
| Over 75 | 39 | 6(20.7) | 13(44.8) | 5(17.2) | 5(17.2) | 2(20) | 3(30) | 3(30) | 2(20) |
| Total | 10111 | 3236(70.9) | 980(21.5) | 271(5.9) | 78(1.7) | 3738(67.4) | 1239(22.3) | 413(7.4) | 156(2.8) |
| P-Value | | $\chi^2 = 525.74$ df = 12 P= 0.001 | | | | $\chi^2 = 586.16$ df = 12 P= 0.001 | | | |

Table 3
Prevalence diastolic of hypertension by gender and age groups among the study subjects

| Age groups (years) | | Male | | | | Female | | | |
|--------------------|-------|------------------------------------------|-----------------|-------------|-------------|-----------------------------------------|-----------------|-------------|-------------|
| Age | N | Normal | Prehypertension | Stage 1 HTN | Stage 2 HTN | Normal | Prehypertension | Stage 1 HTN | Stage 2 HTN |
| 35–44 | 4020 | 1212(65.8) | 469(25.4) | 124(6.7) | 38(2.1) | 1431(65.7) | 556(25.5) | 132(6.1) | 58(2.7) |
| 45–54 | 3154 | 845(61.4) | 343(24.9) | 136(9.9) | 53(3.8) | 962(54.1) | 538(30.3) | 176(9.9) | 101(5.7) |
| 55–64 | 2329 | 542(49.5) | 343(31.4) | 139(12.7) | 70(6.4) | 618(50) | 374(30.3) | 158(12.8) | 85(6.9) |
| 65–74 | 569 | 100(45) | 77(34.7) | 31(14) | 14(6.3) | 158(45.5) | 120(34.6) | 46(13.3) | 23(6.6) |
| Over 75 | 39 | 13(46.8) | 9(31) | 2(6.9) | 5(17.2) | 3(30) | 3(30) | 2(20) | 2(20) |
| Total | 10111 | 2712(59.4) | 1241(27.2) | 432(9.5) | 180(3.9) | 3172(57.2) | 1591(28.7) | 514(9.3) | 269(4.9) |
| P-Value | | $\chi^2 = 137.86$ df = 12 P= 0.001 | | | | $\chi^2 = 155.8$ df = 12 P= 0.001 | | | |

Table 4
The relationship between variables affecting systolic blood pressure using linear regression

| Variable | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|--------------------------------------------|-----------------------------|------------|---------------------------|--------|---------|
| | B | Std. Error | Beta | | |
| Age | .619 | .022 | .320 | 28.584 | < 0.001 |
| BMI | .847 | .037 | .222 | 22.894 | < 0.001 |
| Hip Circumference | .136 | .043 | .065 | 3.138 | .002 |
| HDL | .153 | .011 | .132 | 13.712 | < 0.001 |
| TG | .020 | .002 | .090 | 9.584 | < 0.001 |
| BUN | -.223 | .046 | -.048 | -4.824 | < 0.001 |
| Calcium | .001 | .001 | .028 | 1.668 | .095 |
| Magnesium | .004 | .004 | .042 | .996 | .319 |
| Potassium | -.001 | .000 | -.095 | -2.150 | .032 |
| ALP(Alkaline phosphatase) | .016 | .003 | .061 | 5.968 | < 0.001 |
| Smoking | 2.671 | .438 | .062 | 6.093 | < 0.001 |
| Physical activity (MET-min/week) | -.059 | .015 | -.036 | -3.848 | < 0.001 |
| Has Menopause | 2.183 | .595 | .049 | 3.668 | < 0.001 |
| Has Diabetes | 1.414 | .518 | .025 | 2.729 | < 0.001 |
| Has Cardiac ischemic | 1.470 | .547 | .025 | 2.685 | .007 |
| Has Renal Failure | -4.722 | 1.677 | -.025 | -2.815 | .005 |
| Has Breast feeding | -1.361 | .421 | -.022 | -.209 | 0.041 |
| Dependent Variable: Systole blood pressure | | | | | |

Table 5
The relationship between variables affecting Diastolic blood pressure using linear regression

| Variable | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---------------------------------------------|-----------------------------|------------|---------------------------|--------|---------|
| | B | Std. Error | Beta | | |
| BMI | .591 | .025 | .239 | 23.884 | < 0.001 |
| HipCircumference | .083 | .029 | .061 | 2.811 | .005 |
| Age | .202 | .014 | .161 | 14.293 | < 0.001 |
| HDL. | .095 | .007 | .125 | 12.818 | < 0.001 |
| TG | .014 | .001 | .094 | 9.582 | < 0.001 |
| BUN | -.143 | .032 | -.047 | -4.526 | < 0.001 |
| ALP | .010 | .002 | .061 | 5.652 | < 0.001 |
| Current Smoking | 2.151 | .288 | .076 | 7.467 | < 0.001 |
| Has Menopause | 2.018 | .401 | .069 | 5.030 | < 0.001 |
| Sodium | .000 | .000 | .029 | 3.010 | .003 |
| Calcium | .001 | .001 | .031 | 1.751 | .080 |
| Magnesium | .002 | .003 | .035 | .787 | .431 |
| Potassium | .000 | .000 | -.063 | -1.369 | .171 |
| Physical activity (MET-min/week) | -.027 | .010 | -.026 | -2.669 | .008 |
| Has Brest feeding | -.007 | .003 | -.023 | -2.491 | .013 |
| use hookah | -1.086 | .482 | -.021 | -2.254 | .024 |
| Has Renal Failure | -2.233 | 1.133 | -.018 | -1.972 | .049 |
| Dependent Variable: Diastole blood pressure | | | | | |

Discussion

Hypertension is the most important and prevalent chronic disorders which still remains a major health concern despite medical progresses. Given prevalence of this disease and its serious subsequent complications, the current study aimed to investigate known factors as risk factors for hypertension and the way of their association in study population of the Cohort in south of Iran at 2019.

Number of adults with hypertension in Iran reaches 9 million and 700 thousands individuals at 2015, which more than 5 million and 200 thousands were man and more than 4 million and 500 thousands were woman. Number of individuals with HTN in Iran has been reached more than 9.7 million at 2015 from 4 million individuals (2 million and 100 thousands men and one million and 900 thousands women), which the majority of this increase is a result of increase in population of Iran and increase in life expectancy an aging of the Iranian society[14].

Prevalence of HTN varies in various studies, which in part could be attributed to time difference of studies and regional and ethnical differences. However, very different numbers can also be result of mistake or bias. As an example, in the sugar and lipid study of Tehran, prevalence of HTN in old ages was reported about 47% [15], and or in the study by Sharifi, it was reported as 60% [16].

However, there are studies which estimates this amount as 25% [17], this value in The current study is 42% based on JNC-8. Results of the cohort studies as our study commonly respond better and more accurate for prevalence studies, since they are not affected by bias.

Regarding factors effective in blood pressure, the most association was observed with blood pressure in univariate associations, BMI, BUN, diabetes, cigarette use, and breastfeeding duration.

The study by Rao et al (2012) in India showed that prevalence of elevated blood pressure in Bambaei is about 43%, and the most important factors associated the HTN in their study was odl ages over 40 years, male gender, being diabetic, BMI greater than 25, and a

family history of HTN [18].

The study by Fawokan et al (2018) which investigated factors effective on blood pressure in pediatrics as a systematic review, factors such as gender, being overweight, economic and social status, educational level of parents, being stable, using tobacco and alcohol, and finally dietary regimen were among the factors effective in increase of susceptibility to HTN [19].

The study by Anteneh et al (2015) investigated factors effective in HTN in Ethiopia. In this study, prevalence rate was reported as 25.1%, and age, tobacco use, physical activity, diabetes history, salt intake and BMI were introduced as the most important factors related to HTN [20].

The study by Patra & Bhise (2018) also investigated factors related to HTN in India population and reported general prevalence of HTN about 25%. This study reports factors associated with the disease as age, gender, marital status, habitat, Socioeconomic status, unhealthy behaviors such as tobacco and alcohol and higher BMI [21–22]. Results of our study investigated more variables comparing to most studies which were done in the environment similar to the region we performed the study.

Numerous biochemical and nutritional indices were entered in the study, and for the first time comparing to similar studies, all the medications related to HTN which might affect blood pressure status were investigated (potency of decrease and increase of blood pressure as the side effect) and were entered in the multi-variate analysis to attenuate their effects on blood pressure. Regarding analysis of blood pressure, in order to achieve more accurate results and in order to control the effect of high and low pressure on the results in some groups, regression analysis was used, and as the results show, some of the findings are fully consistent with findings of similar studies. For example, BMI and/or waist circumference which are indices of obesity, almost played critical role in most gender and blood pressure groups, and were considered as significant risk factor for blood pressure.

Of course it should not be neglected that waist circumference in previous similar studies was not used, and index of abdominal obesity which waist circumference is a representative of it was neglected in other studies, while in our study, for SBP and DBP in women, after modification for many known variables, waist circumference showed strong association with HTN. As stated in the other studies that diabetes is considered as a risk factor for HTN, blood sugar showed a strong association with HTN in our study.

Alkaline phosphatase (ALP) considered as an index of hepatic function showed a considerable association with HTN specially SBP which is also pointed in a few studies to date. Regarding variables related to dietary regimen, as expected, and almost all the studies had consensus on it, sodium is associated with HTN, however, interesting point in our study was weak association of it rather than other variables.

While opposite to our expectation, calcium and potassium pointed as anti-HTN factors in many studies, and considered as the components of DASH diet (Dietary Approaches to Stop Hypertension) [23–24], were blood pressure elevator in our study which there is a need to more investigation to better clarify the underlying reason another component of DASH diet.

Another component of DASH diet which is considered as a decreasing factor of HTN is magnesium which in our study showed to be preventive factor which is fully consistent with the findings of other studies [25–26].

Another considerable point in our study was breastfeeding duration in women which is a risk factor for susceptibility to HTN, approximately opposite to other studies which introduce breastfeeding as a preventive factor for HTN [27]. Our study our study showed that breastfeeding duration can increase risk of HTN.

However, the study by Struebe et al (2011) pointed to this tip but they explained the underlying cause so that in 12% of mothers who reported this increase in blood pressure, breastfeeding duration was lesser than the expected one, and they recommended that thorough breastfeeding might prevent this elevation in blood pressure [28].

This is the point should be considered in further studies, however, average breastfeeding duration in our study was considerable comparing to other studies 86.4 ± 58.8 months, which the reason for this considerable and different finding might be due to the long duration of breastfeeding, which we know that it can cause considerable health risks for mother due to mother's reservoir loss.

Conclusions

The findings of the current study showed high prevalence of HTN in the study population, therefore, it is necessary to perform required programming by the managers and policy makers of the health treatment system with the aim of screening to identify hazardous factors,

promote self-care behaviors and management and control of HTN. In addition, since HTN is affected by cultural social and economic factors, it is necessary to conduct studies in other countries especially in cohort format to investigate prevalence and also investigate hazardous factors of HTN.

Abbreviations

HTN: hypertension. SBD: systolic blood pressure. DBP: diastolic blood pressure.

Declarations

Ethics approval and consent to participate

The study protocol was in accordance with the Helsinki Declaration and confirmed by the Ethics Committee of Fasa University of Medical Sciences (Approval Code: IR.FUMS.REC. 1398.063). The participants were informed about the research objectives and the written informed consent was obtained from the subjects before starting the survey.

Consent to publish

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request

Competing interests

The authors declare that they have no conflict of interest

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Authors' Contributions

Conceptualization: MB,SP,RH,MF.

Methodology: MB,RH, MF,MSR,MRC,MK,AG

Software: SP,AD,MMN.

Data curation: AD, MMN, MB

Writing (original draft): MB, RH,MF

Writing (review and editing):MB, RH, MF, MSR,MRC,MK,AG

All authors read and approved the final manuscript.

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