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Original Research Article

Prevalence of hypertension and its association with anthropometric parameters in adult population of Raipur city, Chhattisgarh, India

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ABSTRACT

Background: Obesity is now an important emerging public health problem in India. It is one of the major risk factor for hypertension. Overweight persons have two to six fold increase in the risk of developing hypertension. This study was carried out with objective to find out prevalence of Hypertension and assess its association with four obesity-related indices- body mass index (BMI), waist circumference (WC), waist-to-hip ratio (WHR), and waist-to-height ratio (WHtR).
Methods: A cross-sectional community-based study was done among 640 study subjects of age group 25-59 years during July 2015 to June 2016. Multi stage random sampling method was used. Data collection was done using WHO STEPS instrument V 3.1. Privacy and confidentiality of data was maintained. Data was entered in the Microsoft excel, collected data was checked for its completeness and correctness before data analysis with the help of PSPP software.
Results: Prevalence of hypertension among study subjects was found to be 22.19% (142 out of 640).With respect to body mass index, waist circumference, waist hip ratio and waist height ratio, 4.38%, 64.35%, 85.33%, 76.2% were found to be obese respectively. Hypertension was strongly associated with BMI ($p<0.001$), waist circumference ($p<0.001$), waist hip ratio ($p<0.05$), waist height ratio ($p<0.05$). Out of the four anthropometric variables waist hip ratio (WHR) was most strongly associated with hypertension ($\beta=420.236$, $p=0.007$).
Conclusions: The study shows a rising burden of hypertension among study population. As WHR is the best indicator for measuring obesity, so measurement of WHR should be made compulsory in healthy life style clinics along with other parameters.

Keywords: Adult population, Anthropometric parameters, Hypertension

INTRODUCTION

The global burden of diseases and associated risk factors has changed significantly over the past two decades with a clear shift from communicable to non-communicable diseases.[1,2] Most notably, high blood pressure (BP) has been ranked as the number one contributing factor to the global burden of non-communicable disease, as it is an important and highly prevalent risk factor for both cerebrovascular and cardiovascular disease.[3] Many environmental and genetic factors play a significant role in the causation of blood pressure such as the age, gender, body size, body mass index, physical activity, diet and stress levels. However, during adolescence, the main influencing factor that leads to hypertension is obesity and metabolic syndrome and familial factors of hypertension.[4] Hypertension contributes around 9.4 million deaths worldwide. Compared to year 2000, the number of Hypertensives are likely to increase by 60% to a total of 1.56 billion by the year 2025.[5] According to

WHO the prevalence of hypertension in India was about 36.0 in males and 34.2 in females in 2008.[6] Rizwan SA et al, in a study 'prevalence of hypertension in Indian tribes: a systematic review and meta-analysis of observational studies' found. The pooled estimate of hypertension prevalence was 16.1%.[7] Isolated studies carried out in populations like among Lepchas of Sikkim Himalayas, tribes of Andhra Pradesh, Rajasthan, and Orissa, India have documented the hypertension prevalence in the range of 15 to 42 per cent.[8] Studies have shown Hypertension is related to body mass index (BMI), waist circumference (WC), waist-hip ratio (WHR), waist-to-height ratio (WHtR) etc. A study in urban population of India depicts strong relationship between different anthropometric indicators and blood pressure levels.[9] Obesity has long been established as an important and independent risk factor for the development and complication of hypertension.[10-12]

Body mass index (BMI), waist circumference (WC), waist-to-height ratio (WHtR) and waist-hip ratio (WHR) are simple and valid anthropometric measures for the assessment of obesity and risk of hypertension.[13,14] Ageing population, rapid urbanization and transition from agrarian life to a wage-earning, modern city life are reported as major contributors to increased unhealthy life style pattern in urban areas. Chhattisgarh state is no exception to this. There is paucity of epidemiological studies pertaining to hypertension in Chhattisgarh, India which resulted in undertaking present study. Understanding the role of these modifiable anthropometric parameters is the key to develop a clear and effective strategy for improving community health. The study was done with an objective to find the prevalence of hypertension and its association with anthropometric parameters.

METHODS

The study undertaken was a cross sectional community based study and was done among 640 subjects of age group 25-59 years in Raipur city, Chhattisgarh, India during period July 2015 to June 2016.

Sample size estimation

Sample size was calculated by using WHO statistical formula for sample size determination. The following formula used: $n = Z^2 P (1 – P)/ d^2$. Where n = sample size, Z = Z statistic for a level of confidence (1.96), P = prevalence of Hypertension (50%, P = 0.5), and d = absolute precision (if 4%, d = 0.04).[15]

As there was no baseline study in Raipur, Chhattisgarh, India to estimate 'P', a figure of 50% was used. A total of 600 figures came using statistical formula. In order to give equal representation to all the selected area it was decided to select 40 subjects from each of 16 areas, that came out to be 640. Therefore a total 640 subjects were included in study.

Sampling method

Multi stage random sampling technique.

Informed/verbal consent prior to interview and anthropometric measurements was taken. Adult both male and female of age 25 to 59 years were included in study.

Inclusion criteria

Persons aged 25- <60 years of age both male and female, willing to participate and residing since last year.

Exclusion criteria

- Age <25 years and >59 years.
- Migrants
- Those who are not willing to participate in the study.
- Those who are absent on the day of interview.
- Persons having acute illness, deaf & mute person, communication barrier.

Instruments used for data collection

- Mercury Sphygmomanometer: Blood pressure was measured with a standard mercury sphygmomanometer which was standardized and checked regularly to minimize errors.
- Stethoscope: A standard stethoscope was used to record the blood pressure.
- Weighing machine: A bathroom weighing machine was used to measure the weight of the subjects. It was calibrated and checked regularly.
- Measuring tape: A stiff and non-elastic measuring tape was employed to measure height. Another non elastic measuring was used for measurement of waist and hip circumference.

Operational definition of hypertension (Based on JNC-VII criteria)[2]

Hypertension is defined as systolic blood pressure more than or equal to 140 mmHg or diastolic blood pressure more than or equal to 90 mmHg based. All subjects currently on anti-hypertension medication or having a prescription of antihypertensive drugs were classified as hypertensive irrespective of their current blood pressure reading.

- Waist circumference: Indian Cut-off <85cm (men) and <80 cm (women).[16]
- Waist-hip ratio: Cut off <0.90 (men) and <0.85 (women).[16]
- Waist-height ratio: Cut off <0.5 for men and women.
- BMI classification: As per WHO, BMI ≥25kg/m^2- overweight and ≥30kg/m^2- obese.[17]

Statistical Methods

Data compilation and its analysis was done using SPSS Version 20.0.

RESULTS

Out of total 640 study subjects, 305 (47.7%) were male and 335 (52.3%) were female. The prevalence of Hypertension among male and female were 23.9% and 20.6% respectively. The overall prevalence of Hypertension was 22.2%. The mean Systolic Blood Pressure (SBP) of male and female were 127.26±12.54mm of Hg and 121.63±16.52mm of Hg respectively. Similarly the mean Diastolic Blood Pressure of male and female were 82.34±7.15mm of Hg and 78.63±9.22mm of Hg respectively. The difference in SBP (t=1.96, p<0.001) and DBP (t=1.96, p<0.001) was found to be statistically significant. The mean age of male and female were 38.40±10.29mm of Hg and 37.28±11.02mm of Hg respectively. The mean height of male and female subjects was 165.6±5.44mm of Hg and 154.2±6.09mm of Hg respectively. The mean BMI of male (23.64±3.04) was higher than that of female (23.05±4.37) and the difference was found to be statistically significant (t=1.96, p<0.05). The mean waist –hip ratio in male and female was 0.95±0.06 and 0.91±0.07 respectively. The mean waist circumference ratio in male and female was 87.81±9.11 and 83.65±12.43 respectively. The mean waist –height ratio in male and female was 0.54±0.05 and 0.55±0.08 respectively (Table 1).

Table 1: Baseline characteristics of study population.

Characterstics	Male	Female	Total
Number	305 (47.7%)	335 (52.3%)	640 (100%)
No. of hypertensives	73 (23.9%)	69 (20.6%)	142 (22.2%)
Age (in years)	38.40±10.29	37.28±11.02	37.82±10.68
Height (in cm)	165.6±5.44	154.2±6.09	159.65±8.11
Weight (in Kg)	64.87±9.10	54.89±11.03	59.65±11.31
BMI (Kg/m^2)	23.64±3.04	23.05±4.37	23.34±3.81
Waist-hip ratio	0.95±0.06	0.91±0.07	0.93±0.07
Waist circumference (cm)	87.81±9.11	83.65±12.43	85.66±11.15
Waist-height ratio	0.54±0.05	0.55±0.08	0.54±0.07
SBP (mm of Hg)	127.26±12.54	121.63±16.52	124.31±15.01
DBP (mm of Hg)	82.34±7.15	78.63±9.22	80.40±8.50

Table 2: Distribution of Study subjects according to anthropometric parameters.

Anthropometric parameters	Male	Female	Total
Body mass index			
Underweight	16 (5.3%)	36 (10.7%)	52 (8.1%)
Normal weight	204 (66.9%)	214 (63.9%)	418 (65.3%)
Pre-obese	77 (25.2%)	65 (19.4%)	142 (22.2%)
Obese	08 (2.6%)	20 (6.0%)	28 (4.4%)
Total	305 (47.7%)	335 (52.3%)	640 (100%)
Waist height ratio			
<0.5	60 (19.7%)	91 (27.7%)	151 (23.8%)
≥0.5	245 (80.3%)	238 (72.3%)	483 (76.2%)
Total	305 (48.1%)	329 (51.9%)	634 (100%)
Waist circumference			
< Cut Off	96 (31.5%)	130 (39.5%)	226 (35.6%)
≥ Cut Off	209 (68.5%)	199 (60.5%)	408 (64.4%)
Total	305 (48.1%)	329 (51.9%)	634 (100%)
Waist hip ratio			
<Cut off	34 (11.1%)	59 (17.9%)	93 (14.7%)
≥Cut off	271 (88.9%)	270 (82.1%)	541 (85.3%)
Total	305 (48.1%)	329 (51.9%)	634 (100%)

The prevalence of hypertension increases with age. The trend shows gradual increase in BP with age, maximum (32.4%) in 55-59 years age group and minimum (6.3%) in 25-29 years age group (Figure 1).

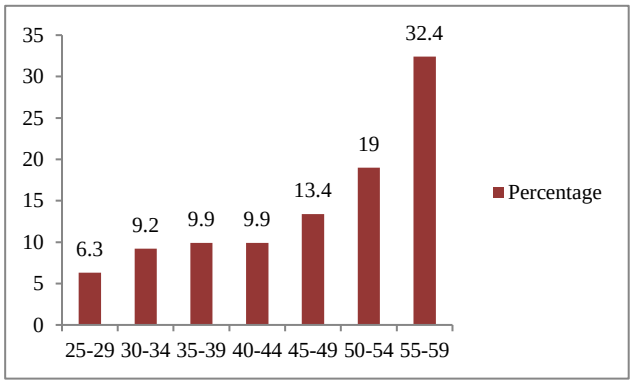

Figure 1: Age wise distribution of hypertensive subjects.

It was found that the overall prevalence of obese was 4.4% (male constituted 2.6% and female constituted 6% obese individuals). 80.3% male and 72.3% female constituted high risk individual as per Waist-Height Ratio and overall 76.2% were at risk. Similarly 64.4% study subjects were at high risk (≥cut off) according to waist circumference. 68.5% of male and 60.5% of female had waist circumference ≥cut off value. Also 85.3% of individuals had waist hip ratio ≥cut off value (male constituted 88.9% and female constituted 82.1% at risk individuals as per waist hip ratio (Table 2).

Significant association was found between hypertension with body mass index (χ^2=80.411, df=1, p<0.001), waist circumference (χ^2=42.089, df=1, p<0.001), waist height ratio (χ^2=19.69, df=1, p<0.001) and waist hip ratio (χ^2=5.65, df=1, p<0.05). The risk of developing hypertension in subjects BMI ≥25 was found to be almost 6 times than the subjects having BMI<25 (OR=5.78). The risk of developing hypertension in subjects Waist circumference ≥cut off was found to be almost 5 times than the subjects having waist circumference <cut off (OR=5.04).

Table 3: Association of hypertension with anthropometric parameters.

Anthropometric parameters	Non- hypertensive	Hypertensive	Statistical analysis
Body mass index			
<25	81.33	45.77	χ^2 =80.411, df=1, p<0.001 OR= 5.78
≥25	18.67	54.23	
Waist circumference			
<Cut Off	42.28	12.68	χ^2 =42.089, df=1, p<0.001 OR= 5.04
≥Cut Off	57.72	87.32	
Waist-hip ratio			
<Cut off	16.46	8.45	χ^2 =5.65, df=1, p<0.05 OR= 2.13
≥Cut off	83.54	91.55	
Waist-height ratio			
<Cut off	27.84	9.86	χ^2 =19.69, df=1, p<0.001 OR= 3.53
≥Cut off	72.16	90.14	

Table 4: Correlation between hypertension and anthropometric parameters.

Anthropometric parameters	Correlation coefficient (r)	p-value
Waist circumference	0.396	p<0.001
Body mass index	0.331	p<0.001
Waist- height ratio	0.352	p<0.001
Waist-hip ratio	0.357	p<0.001

Co-relational analysis shows maximum correlation of prevalence of hypertension with waist circumference (r=0.396, p<0.001) followed by waist hip ratio (r=0.357, p<0.001) and waist-height ratio (r=0.352, p<0.001) and the least body mass index (r=0.331, p<0.001) (Table 4).

Similarly the risk of developing hypertension in subjects waist hip ratio ≥cut off was found to be almost 2 times than the subjects having waist hip ratio <cut off (OR=2.13). Also the risk of developing hypertension in subjects waist height ratio ≥cut off was found to be more than 3 times than the subjects having waist height ratio <cut off (OR=3.53) (Table 3).

Binary logistic regression showed that there was significant association between Waist Hip Ratio with Hypertension [β (95% CI of β)=420.236 (5.032-35097.066) p<0.05]. But the association of waist circumference, waist height ratio, body mass index with hypertension was not found to be statistically significant (p>0.05) (Table 5).

Table 5: Effect of anthropometric co-relates on prevalence of hypertension using binary logistic regression.

Anthropometric parameters	β (95% CI of β)	p-value
Waist circumference	1.051 (0.995-1.109)	0.074
Body mass index	1.048 (0.952-1.153)	0.341
Waist-height ratio	9.118 (0.028-3013.775)	0.455
Waist-hip ratio	420.236 (5.032-35097.066)	0.007

DISCUSSION

In the present study, percentage of subjects having at risk anthropometric indicators were significantly higher in hypertensives than in non-hypertensive population. These findings were similar to study carried by Midha et al in Lucknow district, Uttar Pradesh, India and Kokiwar et al in rural area of Karimnagar, Telangana, India.[18,19] The mean value of all the variables are higher in male compared to female except in weight-height ratio. These findings are similar to that of the study done by Saxsena P et al.[20] Several studies have shown that Central obesity is positively correlated with hypertension.[20-23] Binary logistic regression analysis showed that only waist-hip ratio (β=420.236, p<0.05) was significantly associated with subject hypertensive status. Similar result were also shown by Midha et al and Kaur et al where BMI, Waist circumference were found significant.[18,22] Results of correlation coefficients for all the anthropometric indicators BMI (r=0.331), WHR (r=0.357), WC (r=0.396) WHtR (r=0.352) indicated significant positive correlation similar result were also shown by Ashwini et al in his study.[19] Hypertension was found to be associated with waist-height ratio (χ^2=19.69, df=1, p<0.001 OR=3.53) and waist circumference (χ^2=42.089, df=1, p<0.001 OR=5.04). The findings are similar to the results obtained by Valenzuela K et al.[24] Hypertension was found to be strongly associated with waist-hip ratio (χ^2=5.65, df=1, p<0.05 OR=2.13). Present findings are similar to the study done by Gupta R et al.[25] This study showed significant association between hypertension and BMI (χ^2=80.411, df=1, p<0.001 OR=5.78). Similar study conducted by Dua S et al showed obesity to be important risk factor for hypertension.[26]

As the prevalence of hypertension is high among study population, healthy life style centers NCD clinics should be strengthened to prevent and control hypertension by making early health check-up followed by counseling and reforms. As all the anthropometric parameters are associated with hypertension, urgent initiation of behavior change communication (BCC) should be done to aware the community. Present study shows waist hip ratio is the strongest predictor of hypertension, so measurement of waist-hip ratio should be made compulsory in healthy life style centers along with other parameters. NHM and PPP must gear up mechanism to diagnose, notify and follow up hypertensive cases. Cost-effective and evidence based interventions and tools to prevent and control hypertension have to be integrated in primary health care.

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REFERENCES

1. Lim S, Vos T, Flaxman A, Danaei G, Shibuya K. (2012) A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the global burden of disease study 2010. Lancet. 2012;380:2224-60.
2. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA. (2003) The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure: the JNC 7 Report. JAMA. 2003;289:2560-72.
3. National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents. Pediatrics. 2004;114:555-76.
4. Hansen ML, Gunn PW, Kaebler DC, Under diagnosis of hypertension in children and adolescents. JAMA. 2007:298:874-81.
5. Jones A, Charakida M, Falaschetti E, Hingorani AD, Finer N, Masi S, Donald AE, Lawlor DA, Smith GD, Deanfield JE. Adipose and height growth through childhood and blood pressure status in a large prospective cohort study. Hypertension. 2012;59(5):919-25.
6. WHO. Non communicable diseases in the SouthEast Asia region: situation and response. World Health Organisation, New Delhi. 2011.
7. Rizwan SA. Hypertension in Indian Tribes. PLOS ONE. 2014;9(5):e95896.
8. Mukhopadhyay B, Mukhopadhyay S, Majumder PP. Blood pressure profile of Lepchas of the Sikkim Himalayas: epidemiological study. Hum Biol. 1996;68:131-45.
9. Ramachandran A, Snehalatha C, Viswanathan V, Viswanathan M, Haffner SM. Risk of noninsulin dependent diabetes mellitus conferred by obesity and central adiposity in different ethnic groups: a comparative analysis between Asian Indians, Mexican Americans and Whites. Diabetes Res Clin Pract. 1997;36(2):121-5.
10. de Moraes SA, Checchio MV, de Freitas ICM. The independent effect of central obesity on hypertension in adults living in Ribeirao Preto, SP, 2007. EPIDCV Project. Brazilian J Epidemiol. 2015;18(1):157-73.
11. Park SH, Park JH, Song PS, Kim DK, Kim KH, Seol SH, et al. Sarcopenic obesity as an independent

risk factor of hypertension. J Am Soc Hypertens. 2013;7(6):420-5.
12. Redon J, Cea-Calvo L, Moreno B, Monereo S, Gil-Guillen V, Lozano JV, et al. Independent impact of obesity and fat distribution in hypertension prevalence and control in the elderly. J Hypertens. 2008;26(9):1757-4.
13. Mello RB, Moreira LB, Gus M, Wiehe M, Fuchs FD, Fuchs SC. Central obesity is a risk factor for hypertension independent of body mass index in elderly individuals: Results of a Population-Based study. Circulation. 2011;21:124S.
14. Rodea-Montero ER, Evia-Viscarra ML, Apolinar-Jimenez E. Waist-to-Height ratio is a better anthropometric index than waist circumference and BMI in predicting metabolic syndrome among obese Mexican adolescents. Int J Endocrinol. 2014;2014:19540.
15. Lwanga SK. (1991). Sample size determination in health studies. 1991:25. Available from: http:// apps.who.int/iris/handle/10665/40062. (Last accessed on 2016 June 19).
16. Chamukuttan S, Vijay V, Ambadi R. Cut-off values for normal anthropometric variables in Asian Indian adults. Diabetes Care. 2003;26(5):1380-84.
17. World Health Organization. Non-communicable diseases. WHO; 2014. Available from: http:// www.who.int/mediacentre/factsheets/fs355/en/. (Accessed on 2016 Jun 23).
18. Midha T, Idris MZ, Saran RK, Srivastava AK, Singh SK.A study on the association between hypertensive status and Anthropometric correlates in the Adult Population of Lucknow District, India Indian J Prev Soc Med. 2009;40(1 and 2):49-54.
19. Ashwini CA, Roopakala MS, Jagadish S, Kulkarni R. Correlation of anthropometric measurements of ultrasonic measurement of abdominal fat in adults with hypertension. Anatomica Karnataka. 2010;4(2):28-34.
20. Saxena P, Prakash D. A correlative study on hypertension and anthropometric parameters in rural population of Tehri- Garhwal. Indian J Prev Soc Med. 2014;45(1-2):36.
21. Kokiwar PR, Gupta SS. Prevalence of hypertension in a rural community of central India. Int J Biol Med Res. 2011; 2(4): 950-3.
22. Kaur P, Radhakrishnan E, Sankarasubbaiyan S, Rao SR, Chennakesavan SK, Rao TV, et al. A comparison of anthropometric indices for predicting hypertension and Type 2 Diabetes in a male industrial population of Chennai, South India. J Ethnicity Dis. 2008;18:31-36.
23. Dhall M, Gupta S, Bhuker M, Sharma P, Kapoor S. Effectiveness of various anthropometric indices in prediction of cardiovascular risk among adult Jains. Open Anthropol J. 2011;4;33-9.
24. Valenzuela K, Bustos P. Waist:height ratio as a predictor of risk of hypertension in young adults: is it better indicator that waist circumference. Archivos latinoamericanos de nutricion. 2012;62(3):220-6.
25. Gupta R, Mehrishi S. Waist-hip ratio and blood pressure correlation in an urban Indian population. J Indian Med Assoc. 1997;95(7):412-5.
26. Dua S, Bhuker M, Sharma P, Dhall M, Kapoor S. Body mass index relates to blood pressure among adults. North Am J Med Sci. 2014;6(2):89.

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