Research Article

Association of hypertension with obesity among adults in a rural population of Jharkhand

Chandramani Kumar[1], Kumari Asha Kiran[2], Vidya Sagar[2], Mithilesh Kumar[2]

[1]Department of Community and Family Medicine, All India Institute of Medical Sciences (AIIMS), Patna, Bihar, India.
[2]Department of Social and Preventive Medicine, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, India.
Correspondence to: Chandramani Kumar, E-mail: drchandramani82@gmail.com

Received May 31, 2016. Accepted June 10, 2016

Abstract

Background: Obesity is an important risk factor for hypertension, diabetes mellitus, dyslipidemia, and other non-communicable diseases. India is passing through nutrition transition and prevalence of obesity and hypertension is on the rise.

Objectives: The present study was carried out with the aim to determine the prevalence of hypertension and association with obesity in a rural population of Jharkhand.

Material and Methods: A cross-sectional study was carried out in a rural area of Ranchi district of Jharkhand. In total, 500 study subjects were included in the study after assessing their eligibility for the study. Cluster sampling was done. A pretested semi-structured questionnaire was used for data collection. Statistical analyses were carried out by SPSS software.

Results: Out of 500 study subjects, 99 (19.8%) were found to be hypertensive. Around one-third (171; 34.2%) of the subjects were overweight, and 21 (4.2%) subjects were obese. Central obesity was found to be higher among female subjects (54.9%) as compared to male subjects (16.3%) in the present study. The prevalence of hypertension was found to be higher among subjects having higher BMI. This association was found to be statistically significant (p-value = < 0.001). Central obesity was found to be significantly associated with hypertension among male subjects statistically significant (p-value = < 0.001) whereas this association was not found among female subjects (p-value = 0.204).

Conclusion: Obesity was found to be significantly associated with hypertension in the present study.

KEY WORDS: Hypertension, obesity, rural, adult, Jharkhand

Introduction

Obesity which is often expressed in terms of body mass index (BMI) may be defined as an abnormal growth of the adipose tissue because of an enlargement of fat cell size or an increase in fat cell number or a combination of both.[1] Excess abdominal fat is an independent predictor of the risk factors and the morbidity of obesity related diseases such as type 2 diabetes, hypertension, dyslipidemia, and cardiovascular diseases. Abdominal obesity and elevated blood pressure commonly occur in the same patient and are key components of the metabolic syndrome.[2]

Globally, the overall prevalence of raised blood pressure in adults aged 18 and over was around 22% in 2014. Across the WHO regions, the prevalence of raised blood pressure was highest in Africa, where it was 30% for both sexes combined as well as for men and women separately. The lowest prevalence of raised blood pressure was in the WHO Region of the Americas at 18% for both sexes. Among adults in South East Asia region, prevalence of hypertension is reported about 35%.[3]

Approximately 30–35% or urban Indian adults have a body mass index (BMI) ≥ 25 kg/m^2 and, therefore, are classified as either overweight or obese and there is a significant correlation of increasing body weight with hypertension.[4]

Access this article online	
Website: http://www.ijmsph.com	Quick Response Code:
DOI: 10.5455/ijmsph.2016.31052016522	

The Jaipur urban (both sexes)[5] and rural studies (only males), Haryana (Chandigarh) rural study,[6] the Chennai urban population study[7] as well as the Bombay executive study[8] have all shown a higher weight and BMI amongst hypertensive groups. With rare exception, clinical trials have documented that weight loss lowers BP. Importantly, reductions in BP occur before, and without, attainment of a desirable body weight. Additional trials have documented that modest weight loss, with or without sodium reduction, can prevent hypertension by about 20% among overweight, pre-hypertensive individuals, and can facilitate medication step-down and drug withdrawal.[9–12] Thus, the available evidence strongly supports weight reduction; attainment of a BMI < 25 kg/m^2 or even < 23 kg/m^2 in Indians as effective approach to prevent and treat hypertension. More importantly, in view of the well-recognized difficulties of sustaining weight loss, efforts to prevent weight gain among those who have normal body weight are critically important. Central or truncal obesity is also a major hypertension risk factor in Indians.[13] The present study was conducted to determine the prevalence, awareness, and risk factors for hypertension in a rural area of Jharkhand. Some part of this study has been published earlier.[14,15]

Material and Methods

A community-based cross-sectional study was conducted in the rural health training center area of Rajendra Institute of Medical Sciences (RIMS), Ranchi from January 2013 to September 2014. Sample size was calculated by n-Master software 2.0 developed at CMC, Vellore, India. Cluster sampling was done in the present study. Based on literature search; assuming expected prevalence of hypertension as 20%, absolute precision of 5%, design effect of 2, and 95% confidence interval, a sample size of 492 was calculated. In total, 500 study subjects were selected for the study. Details of sampling technique, methods of subject selection, and eligibility criteria have been discussed in detail in previously published articles.[14,15]

A pre-tested, semi-structured questionnaire was used for data collection. A person was considered hypertensive if he/she has a systolic BP of ≥ 140 mm Hg and/or a diastolic BP of ≥ 90 mm Hg measured on two separate occasions with a minimum interval of at least 5 min between the two measurements OR a self-reported history of taking anti-hypertensive medications.[16] Blood pressure was measured in sitting position by well maintained and properly calibrated Diamond regular mercury sphygmomanometer (IS: 3390/CM/L-0196043) with appropriate cuff size (cuff bladder encircling at least 80% of the arm). The average of two measurements was taken for study. Body weight was measured by digital weighing machine, whereas waist circumference, hip circumference, and height were measured by flexible but stretch resistant tape. Body weight was measured (to the nearest 0.5 kg) with the subject standing motionless on the weighing scale, feet about 15 cm apart and weight equally distributed on each leg. Subjects were instructed to wear minimum outwear (as culturally appropriate) and no footwear while there weight was being measured. Height was measured (to the nearest 0.5 cm) with the subject standing in an erect position against a vertical surface, and the head positioned so that the top of the external auditory meatus was level with the inferior margin of the bony orbit (Frankfurt's plain). Waist circumference was measured with a standard measuring tape, while subjects were lightly clothed, at a level midway between the lower margin of the last rib and iliac crest in mid-axillary line (to the nearest 0.1 cm). Study was approved by Institutional Ethical Committee of RIMS, Ranchi.

Statistical Analysis

Data entry was performed in the MS excel spreadsheet. Data analysis was carried out using SPSS software. Chi-square test was applied to see the association between categorical variables.

Results

In the present study, 263 (52.6%) subjects were male whereas 237 (47.4%) subjects were female. Mean age of the study subjects was 44.12 (SD – 13.64) years. More than half (55.8%) of the study subjects were literate and majority belonged to class IV and class V group of social class according to modified BG Prasad classification (Table 1). Prevalence of hypertension in the present study was found to be 19.8%. A sizable population (138; 27.6%) was found to be pre-hypertensive (Table 2).

Findings of the present study revealed that more than half (258; 51.6%) of the study subjects from both sexes were having normal BMI. Around one-third (171; 34.2%) of the subjects were overweight and only 21 (4.2%) subjects were obese. Waist circumference was measured for assessment of central (abdominal) obesity in both sexes. Cut off for central obesity was taken 90 and 80 cm for male and female subjects, respectively. It was found that central obesity was higher among female subjects (54.9%) as compared to male subjects (16.3%) (Tables 3 and 4).

Highest (57.1%) prevalence of hypertension was found among subjects with BMI of ≥ 27.50 and lowest (13.2%) among subjects with normal BMI (18.50–22.99). This difference in prevalence of hypertension was statistically significant (p-value = < 0.001). (Table 5) Prevalence of hypertension was more among male subjects with central obesity (44.2%) than those without central obesity (18.6%). The association between hypertension and central obesity was statistically significant (p-value = < 0.001) among male subjects. Among female subjects too, prevalence of hypertension was higher among those with central obesity (19.2%) than those without central obesity (13.1%). However, association between hypertension and central obesity in the present study was not statistically significant (p-value = 0.204) among female subjects (Tables 6 and 7).

Table 1: Selected socio-demographic profile of study subjects (*n* = 500)

Variables	Frequency	Percentage
Gender		
Male	263	52.6
Female	237	47.4
Age (in years), Mean – 44.12, SD – 13.64		
20–29	90	18.0
30–39	109	21.8
40–49	125	25.0
50–59	92	18.4
60 and above	84	16.8
Education		
Illiterate	221	44.2
Less than 10th std	170	34.0
10th std or above	109	21.8
*Socio-economic status**		
Class I	2	0.4
Class II	17	3.4
Class III	31	6.2
Class IV	206	41.2
Class V	244	48.8

*As per modified Prasad's classification for May 2014.[20]

Table 2: Status of blood pressure of subjects under study (*n* = 500)

Blood pressure status	Number	Percentage
Normal	263	52.6
Pre-hypertension	138	27.6
Hypertension		
Stage I	83	16.6
Stage II	16	3.2
Total	500	10St0.0

Mean SBP – 122.83, SD – 15.83, Mean DBP – 79.24, SD – 8.73.

Table 3: Distribution of study subjects according to BMI (*n* = 500)

Body mass index (BMI)	Number	Percentage
< 18.50	50	10.0
18.50–22.99	258	51.6
23.00–27.49	171	34.2
≥ 27.50	21	4.2
Total	500	100.0

Discussion

Obesity is one of the important risk factors for development of hypertension. Body weight has a direct relation with blood pressure.[17] Abdominal obesity is also an independent risk factor for the development of hypertension. In this study

Table 4: Waist circumference of subjects (*n* = 500)

Gender	Waist circumference	Number	Percentage
Male* (*n* = 263)	< 90 cm	220	83.7
	≥ 90 cm	43	16.3
Female**	< 80 cm	107	45.1
(*n* = 237)	≥ 80 cm	130	54.9

*Mean – 84.19, SD – 7.16; **Mean – 81.21, SD – 7.98.

Table 5: Association of BMI with prevalence of hypertension (*n* = 500)

BMI	No hypertension	Hypertension	Total
< 18.50	38 (76.0%)	12 (24.0%)	50 (100.0%)
18.50–22.99	224 (86.8%)	34 (13.2%)	258 (100.0%)
23.00–27.49	130 (76.0%)	41 (24.0%)	171 (100.0%)
≥ 27.50	9 (42.9%)	12 (57.1%)	21 (100.0%)
Total	401 (80.2%)	99 (19.8%)	500 (100.0%)

χ^2 = 27.999, df = 3, *p*-value = < 0.001.

Table 6: Association between waist circumference of male subjects and hypertension (*n* = 263)

Waist circumference	No hypertension	Hypertension	Total
< 90 cm	179 (81.4%)	41 (18.6%)	220 (100.0%)
≥ 90 cm	24 (55.8%)	19 (44.2%)	43 (100.0%)
Total	203 (77.2%)	60 (22.8%)	263 (100.0%)

χ^2 = 13.334, df = 1, *p*-value = < 0.001.

Table 7: Association between waist circumference of female subjects and hypertension (*n* = 237)

Waist circumference	No hypertension	Hypertension	Total
< 80 cm	93 (86.9%)	14 (13.1%)	107 (100.0%)
≥ 80 cm	105 (80.8%)	25 (19.2%)	130 (100.0%)
Total	198 (83.5%)	39 (16.5%)	237 (100.0%)

χ^2 = 1.613, df = 1, *p*-value = 0.204.

obesity was measured by body mass index (BMI) cut offs recommended for Asian population whereas abdominal obesity was measured by waist circumference. Both waist circumference and waist to hip ratio are being used for measurement of abdominal obesity by researchers across the world. For present study, waist circumference was chosen for measurement of abdominal obesity because it is highly feasible, convenient, simple, and inexpensive method of monitoring body fat distribution. Waist circumference remains a simple and valid marker of the abdominal and visceral fat.[18]

The present study has found that more than one-third of the study subjects were either pre-obese or obese.

Hypertension was found to be associated with BMI of the study subjects as prevalence of hypertension was higher among pre obese and obese subjects as compared to subjects with normal BMI. This association was statistically significant and found to be an important risk factor on logistic regression analysis. This finding of present study is similar to the study done by Meshram et al[19] in Kerala among adult tribal population. Many other Indian studies have found significant association between BMI and hypertension; both in rural as well as urban population.[20–24] Although many of these studies had used higher cut off value for classification of BMI as compared to present study, association between obesity and hypertension was found to be statistically significant in all these studies.

Findings of the present study also show that more than half of the female subjects and lesser than one-fifth of male subjects had abdominal obesity. The prevalence of hypertension was higher among both male and female subjects with abdominal obesity than those without abdominal obesity. However, significant association between abdominal obesity and hypertension was found for male subjects only. Significant association between abdominal obesity and hypertension was reported by Meshram et al[19] and in a multi-centric study[25] in India. Both these study had used waist circumference as a measure for abdominal obesity, though higher cut off was taken in later study. Significant association between abdominal obesity and hypertension has been reported in many other Indian studies using waist to hip ratio as a measure of abdominal obesity.[21,26,27] Limited study area is one of the main limitations of the present study as it cannot be generalized to a larger population. Smaller sample size is another important limitation. In conclusion, nearly one-fifth (19.8%) of the study subjects were found to be hypertensive in the present study. In the present study, total 4.2% of the study subjects were obese whereas 34.2% were overweight. Central obesity was present in more than half of the female subjects. Hypertension was significantly associated with BMI of the study subjects from both sex and with central obesity among male subjects.

Conclusion

Proportion of women with abdominal obesity was more than three times higher than men. Obesity was found to be significantly associated with hypertension in the present study.

Acknowledgments

Researchers are thankful to subjects for their participation in the study. The authors are also thankful to ANM, AWW, and ASHA workers from the study area who played important role in smooth conduction of the study. Acknowledgment will be incomplete without mentioning Mr Gyan Prakash Akhouri (MSW) from the Department of PSM RIMS Ranchi who constantly worked with researchers in this study.

References

1. Park K. *Park's Textbook of Preventive and Social Medicine. Epidemiology of Chronic Non-communicable Diseases and Conditions: Obesity*. 22nd ed. Jabalpur: Banarsidas Bhanot, 2013. pp. 367–71.
2. Jordan J, Birkenfeld AL. Cardiometabolic crosstalk in obesity-associated arterial hypertension. Rev Endocr Metab Disord. Springer. DOI 10.1007/s11154-016-9348-1.
3. World Health Organization. *High Blood Pressure, Global and Regional View*. http://www.searo.who.int/entity/world_health_day/leaflet_burden_hbp_whd_2013.pdf?ua=1
4. Sharma BK, Sagar S, Chugh KS. Spectrum of reno-vascular hypertension in the young in north India: A hospital based study on occurrence and clinical features. Angiology 1985;36(6):370–8.
5. Gupta R, Gupta S, Gupta P, Prakash H. Prevalence and determinants of hypertension in the urban population of Jaipur in Western India. J Hypertens 1995;13:1193–200.
6. Malhotra P, Kumari S, Kumar R, et al. Prevalence and determinants of hypertension in an un-industrialized rural population of North India. J Hum Hypertens 1999;13(7):467–72.
7. Shantirani CS, Pradeepa R, Deepa R, Premlata G, Saroja R, Mohan V. Prevalence and risk factors of hypertension in a selected South Indian Population – The Chennai urban population study. J Assoc Physicians India 2003;51:20–7.
8. World Health Organization. *World Health Statistics*, 2012. http://www.who.int/gho/publications/world_health_statistics/2012/en/
9. Appel LJ, Brands MW, Daniels SR, Karanja N, Elmer PJ, Sacks FM. American Heart Association. Dietary approaches to prevent and treat hypertension: A scientific statement from the American Heart Association. Hypertension 2006;47:296–308.
10. The Trials of Hypertension Prevention, Phase II. The Trials of Hypertension Prevention Collaborative Research Group. Effects of weight loss and sodium reduction intervention on blood pressure and hypertension incidence in overweight people with high-normal blood pressure. Arch Intern Med 1997;157: 657–67.
11. Stevens VJ, Obarzanek E, Cook NR, Lee IM, Appel LJ, West D, et al, Trials for the Hypertension Prevention Research Group. Long-term weight loss and changes in blood pressure: results of the Trials of Hypertension Prevention, phase II. Ann Intern Med 2001;134:1–11.
12. Whelton PK, Appel LJ, Espeland MA, Applegate WB, Ettinger WH Jr, Kostis JB, et al. Sodium reduction and weight loss in the treatment of hypertension in older persons: a randomized controlled trial of nonpharmacologic interventions in the elderly (TONE): TONE collaborative research group. JAMA 1998;279:839–46.
13. Gupta R, Rastogi P, Sarna M, Gupta VP, Sharma SK, Kothari K. Body-mass index, waist-size, waist-hip ratio and cardiovascular risk factors in urban subjects. J Assoc Physicians India 2007;55:621–7.
14. Kumar C, Haider S, Kashyap V. Prevalence of hypertension and its association with dietary practices in a rural area of Ranchi district of Jharkhand. Indian J Community Health 2014;26 (Suppl S2):209–15.
15. Kashyap V, Kumar C, Haider S, Singh SB, Sagar V. Prevalence of hypertension and its association with selected socio-demographic factors in a rural area of Jharkhand. IOSR J Dent Med Sci (IOSR-JDMS) 2015;14(4):1–6 [Version IV] DOI: 10.9790/0853-14440106
16. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, et al. 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.
17. Park. K. *Park's Textbook of Preventive and Social Medicine. Non Communicable Diseases: Hypertension*. 22nd edn. Jabalpur: M/s Banarsidas Bhanot, 2013. pp. 344–8.
18. Anuradha R, Hemachandran S, Dutta Ruma. The waist circumference measurement: A simple method for assessing the abdominal obesity. J Clin Diagn Res 2012;6(9):1510–3.
19. Meshram II, Arlappa N, Balakrishna N, Rao KM, Laxmaiah A, Brahmam G. Prevalence of hypertension and its correlates and awareness among adult tribal population of Kerala state, India. J Postgrad Med 2012;58:255–61.
20. Kannan L, Satyamoorthy TS. An epidemiological study of hypertension in rural household community. Sri Ramchandra J Med 2009;II(2)
21. Agrawal VK, Bhalwar R, Basannar DR. Prevalence and determinants of hypertension in a rural community. MJAFI 2008;64(1):21–5.
22. Reddy SS, Prabhu GR. Prevalence and risk factors of hypertension in adults in an urban slum of Tirupati, A.P. IJCM 2005;30(3):84–6.
23. Gupta R, Prakash CD, Achari V, Bhansali A, Gupta BK, Gupta A, et al. Normotension, prehypertension, and hypertension in urban middle-class subjects in India: Prevalence, awareness, treatment, and control. Am J Hypertens 2013;26(1):83–94.
24. Sagare SM, Rajderkar SS, Girigosavi BS. Certain modifiable risk factors in essential hypertension: a casecontrol study. NJCM 2(1):9–13.
25. Manimunda SP, Sugunan AP, Benegal V, Balakrishna N, Rao MV, Pesala KS. Association of hypertension with risk factors & hypertension related behaviour among the aboriginal Nicobarese tribe living in Car Nicobar Island, India. Indian J Med Res 2011;133:287–93.
26. Vozoris NT. The relationship between insomnia symptoms and hypertension using United States population level data. J Hypertens 2013;31(4):663–71.
27. Sathish T, Kannan S, Sarma PS, Razum O, Thankappan KR. Incidence of hypertension and its risk factors in rural Kerala, India: A community based cohort study. Public Health 2012; 126(1):25–32.

How to cite this article: Kumar C, Kiran KA, Sagar V, Kumar M. Association of hypertension with obesity among adults in a rural population of Jharkhand. Int J Med Sci Public Health 2016;5: 2545-2549

Source of Support: Nil, **Conflict of Interest:** None declared.