

## ASSESSMENT OF RISK FACTORS OF HYPERTENSION AMONG ADULTS RESIDING IN URBAN SLUM OF DELHI

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### ABSTRACT

**Objective:** The objective of this study is to assess the risk factors of hypertension among adults residing in urban slums of West Delhi.

**Methods:** A cross-sectional study was carried out among adult population of 18–59 years residing in urban slums of West Delhi. Blood pressure was measured twice using digital machine (OMRON). Height, waist circumference, and hip circumference were measured, weight was taken, and body mass index (BMI) was calculated. The Joint National Committee VII criteria were used to define hypertension, and the National Cholesterol Education Program and Adult Treatment Panel-III guidelines were used to define different categories of dyslipidemia. The World Health Organization (2014) criteria were used to classify the BMI.

**Results:** The overall prevalence of hypertension among adults (n=423) was 25.3%. Among hypertensive adults, the prevalence of obesity was 22.7%, while among non-hypertensives, it was 10.9%. Similarly, overweight prevalence was higher (27.3%) in hypertensive adults compared to non-hypertensive adults (20.6%). The overall prevalence of hypercholesterolemia, hypertriglyceridemia, high-density lipoprotein-cholesterol <40/<50 mg/dl, and low-density lipoprotein-cholesterol (LDL-C)  $\geq 130$  was 19.7%, 33.7%, 75.7%, and 21.8%, respectively. The prevalence of hypercholesterolemia, hypertriglyceridemia, and serum LDL-C  $\geq 130$  mg/dl was 38%, 50%, and 32% among hypertensive adults, while among non-hypertensive adults, it was 15%, 29%, and 19%, respectively.

**Conclusion:** Hypertensive adults had higher BMI, serum cholesterol, triglycerides, and LDL-C compared to non-hypertensives.

**Keywords:** Hypertension, Dyslipidemia, Body mass index.

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### INTRODUCTION

In India, the prevalence of non-communicable disease has increased substantially from 1990 to 2016. Around a quarter of the disability-adjusted life years in India in 2016 is contributed by dietary risks, high systolic blood pressure, high fasting plasma glucose, high total cholesterol (TC), and high body mass index (BMI) [1].

Hypertension and dyslipidemia are two major risk factors of cardiovascular disease [2]. Trend analysis of dyslipidemia in India revealed that over a 20-year period TC, low-density lipoprotein-cholesterol (LDL-C), and triglyceride (TG) levels have increased among urban population in India [3]. A recent survey of the National Nutrition Monitoring Bureau Survey indicated an overall prevalence of hypertension among urban adult men and women in selected states of India as 31% and 26%, respectively [4]. Recent survey of the National Family Health Survey ([NFHS] 4; 2015–2016) also indicated increased prevalence of overweight or obesity (BMI  $\geq 25.0$  kg/m<sup>2</sup>) among adult men (20.7%) and women (18.6%) as compared to NFHS 3 (2005–2006), where prevalence of overweight or obesity was 12.6% and 9.3% among adult men and women [5].

The present study was carried out to assess the risk factors of hypertension among adults residing in slums of Delhi.

### METHODS

The cross-sectional study was carried out in adult population residing in urban slums of West Delhi. A total of 423 adults aged 18–59 years

were enrolled in the study. The study population belonged to low socioeconomic background and are mainly migrants from neighboring states, i.e., Uttar Pradesh and Bihar.

Of 423 adults enrolled, blood pressure was measured from 423 adults, anthropometric measurements were taken from 304 adults, and blood samples were collected in 309 adults. Blood pressure was measured twice using digital machine (OMRON) and average was taken to assess the prevalence of hypertension.

Height and weight were recorded using a calibrated anthropometric rod with a sensitivity of 0.1 cm and calibrated digital scale with a sensitivity of 0.1 kg, respectively. Waist circumference (WC) and hip circumference (HC) were measured using calibrated non-stretchable fiber glass tape. BMI was calculated by dividing the body weight (in kilograms) by the square of height (in meters).

Five ml of venous blood was drawn using disposable syringe and serum was separated for estimation of lipid profile. TC, high-density lipoprotein-cholesterol (HDL-C), and TG were estimated by enzymatic method using fully automatic analyzer (Roche Hitachi-902). All biochemical analysis was done at a National Accreditation Board for Testing and Calibration Laboratories Accredited Laboratory, Centre for Promotion of Nutrition Research and Training with special focus on North-East, Tribal and Inaccessible Population Indian Council of Medical Research (ICMR), New Delhi. Strict internal and external quality control of sample analysis was maintained by running controls along with the samples and by participating in BIORAD, USA, external quality assurance program.

The Joint National Committee VII criteria [6] were used to define hypertension and the National Cholesterol Education Program and Adult Treatment Panel-III guidelines [7] were used to define different categories of dyslipidemia. The World Health Organization (2014) [8] criteria were used to classify the BMI. The biochemical, anthropometric, and blood pressure data were analyzed for percent prevalence, mean, and standard deviation. The Institutional Ethical Clearance was obtained and informed consent was taken from all the study volunteers.

## RESULTS

The overall prevalence of hypertension among adults (n=423) was 25.3%. The prevalence of hypertension was higher (43.0%) among adults aged 46–59 years as compared to adults aged 18–45 years (19.8%).

The mean height and weight of male adults were 161.9 cm and 62.1 kg, whereas those of female adults were 149.3 cm and 57.1 kg (Table 1). The mean level of waist and HC of the male subjects was 85.7 cm and 89.8 cm, respectively, while for female, the mean waist and HC of the females was 86.2 cm and 95.7 cm, respectively. As indicated in Table 1, the mean height, weight, BMI, WC, and HC were higher among hypertensive subjects compared to non-hypertensive subjects.

Prevalence of obesity, overweight, normal BMI, and underweight was classified according to blood pressure (Table 2). Prevalence of obesity (22.7%) and overweight (27.3%) was higher among hypertensive subjects compared to non-hypertensive subjects, where prevalence of obesity and overweight was 10.9% and 20.6%, respectively.

The overall prevalence of hypercholesterolemia ( $\geq 200$  mg/dl), hypertriglyceridemia ( $\geq 150$  mg/dl), and hypoalphalipoproteinemia ( $< 40$  mg/dl [M];  $< 50$  mg/dl [F]) was 19.7%, 33.7%, and 75.7%, respectively (Table 3). Around 22% of adults had LDL-C  $\geq 130$  mg/dl.

The prevalence of hypercholesterolemia and hypertriglyceridemia was higher in females (24.2% and 40.6%) compared to males where their prevalence was 14.6% and 25.7%, respectively.

Around 38%, 50%, and 32% hypertensive adults had serum cholesterol  $\geq 200$  mg/dl, serum TG  $\geq 150$  mg/dl, and serum LDL-C  $\geq 130$  mg/dl, respectively (Table 4). The corresponding values among non-hypertensive adults were around 15%, 29%, and 19%.

## DISCUSSION

Our study indicated higher BMI, serum cholesterol, TGs, and LDL-C among hypertensives compared to non-hypertensives. BMI and blood pressure are reported to be positively correlated [9]. Our study also indicated a higher prevalence of obesity (22.7%) and overweight (27.3 %) among hypertensive subjects compared to non-hypertensive subjects, where the prevalence of obesity and overweight was 10.9% and 20.6%, respectively. A study using 2009–2010, NHANES data, also revealed that both BMI and WC were significant predictors of hypertension [10]. Another study carried out in Nagpur among 370 adults aged 18–40 years reported that high BMI, high waist to hip ratio, and age group of 30–40 years were found to be associated with hypertension [11].

High LDL C, low HDL-C, and high TGs are the most common type of dyslipidemia in India [3]. Trend analysis of over two decades using data of two representative cross-sectional surveys conducted among men and women aged 35–64 years, residing in urban and rural areas (survey 1 [1991–1994], and survey 2 [2010–2012]) in the National Capital Region of Delhi indicated that rapid rise in the burden of risk factors such as overweight, raised blood pressure, and raised blood glucose [12]. Indian diabetic population is also reported to have lower HDL-C and higher LDL [13].

Our study indicated high LDL-C, low HDL-C, high TGs, and high TC among 21.8%, 75.8%, 33.7%, and 19.7%, respectively. A multicenter

**Table 1: Mean $\pm$ SD anthropometric measurement and blood pressure of adults**

Anthropometric measurement	All			Hypertensive			Non-hypertensive		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Height (cm)	161.9 $\pm$ 6.6	149.3 $\pm$ 7.2	155.6 $\pm$ 6.9	163.1 $\pm$ 5.0	150.6 $\pm$ 6.3	156.8 $\pm$ 5.6	160.8 $\pm$ 8.2	148.1 $\pm$ 5.1	154.0 $\pm$ 6.6
Weight (kg)	62.1 $\pm$ 9.1	57.1 $\pm$ 12.4	59.6 $\pm$ 10.7	66.9 $\pm$ 7.7	60.1 $\pm$ 13.2	63.5 $\pm$ 10.4	57.4 $\pm$ 10.5	54.2 $\pm$ 11.6	55.8 $\pm$ 11.0
BMI (kg/cm <sup>2</sup> )	23.7 $\pm$ 3.6	25.5 $\pm$ 5.0	24.6 $\pm$ 4.3	25.2 $\pm$ 2.8	26.4 $\pm$ 5.2	25.8 $\pm$ 4.0	22.3 $\pm$ 4.5	24.6 $\pm$ 4.9	23.4 $\pm$ 4.7
WC (cm)	85.7 $\pm$ 10.6	86.2 $\pm$ 14.0	85.9 $\pm$ 12.3	90.4 $\pm$ 8.7	90.1 $\pm$ 14.5	90.2 $\pm$ 11.6	81.1 $\pm$ 12.6	82.3 $\pm$ 13.5	81.7 $\pm$ 13.0
HC (cm)	89.8 $\pm$ 7.3	95.7 $\pm$ 11.2	92.7 $\pm$ 9.2	91.9 $\pm$ 6.5	98.5 $\pm$ 12.3	95.2 $\pm$ 9.4	87.7 $\pm$ 8.2	92.9 $\pm$ 10.2	90.3 $\pm$ 9.2
Waist to hip ratio	0.9 $\pm$ 0.1	0.9 $\pm$ 0.2	0.9 $\pm$ 0.1	1.0 $\pm$ 0.1	0.9 $\pm$ 0.2	0.9 $\pm$ 0.1	0.9 $\pm$ 0.1	0.9 $\pm$ 0.2	0.9 $\pm$ 0.1

SD: Standard deviation, BMI: Body mass index, WC: Waist circumference, HC: Hip circumference

**Table 2: BMI according to blood pressure**

BMI	Hypertensive			Non-hypertensive		
	All (n=66)	Male (n=24)	Female (n=42)	All (n=238)	Male (n=109)	Female (n=129)
Obese	15 (22.7)	2 (8.3)	13 (31.0)	26 (10.9)	7 (6.4)	19 (14.7)
Overweight	18 (27.3)	8 (33.3)	10 (20.6)	49 (20.6)	14 (12.8)	35 (27.1)
Normal	32 (48.5)	14 (42.9)	18 (54.6)	130 (54.6)	69 (63.3)	61 (47.3)
Underweight	1 (1.5)	0 (2.4)	1 (13.9)	33 (13.9)	19 (17.4)	14 (10.9)

Figures in parenthesis are percent prevalence. BMI: Body mass index

**Table 3: Prevalence of dyslipidemia according to gender**

Type of dyslipidemia	n	All	n	Male	n	Female
Hypercholesterolemia ( $\geq 200$ mg/dl mg/dl)	309	61 (19.74)	144	21 (14.58)	165	40 (24.24)
Hypertriglyceridemia ( $\geq 150$ mg/dl)	309	104 (33.66)	144	37 (25.69)	165	67 (40.61)
Hypoalphalipoproteinemia (HDL $<$ 40 mg/dl-male HDL $<$ 50 mg/dl-female)	309	234 (75.73)	144	92 (63.89)	165	142 (86.06)
LDL-C ( $\geq 130$ mg/dl)	298	65 (21.81)	129	28 (21.71)	161	36 (22.36)

Figures in parenthesis are percent prevalence. HDL: High-density lipoprotein, LDL-C: Low-density lipoprotein-cholesterol

Table 4: Prevalence of dyslipidemia according to blood pressure and gender

Type of dyslipidemia	Hypertensive			Non-hypertensive								
	n	All	n Male	n Female	n	All	n Male	n Female				
Hypercholesterolemia ( $\geq 200$ mg/dl mg/dl)	70	27 (38.57)	30	9 (30.00)	40	18 (45.00)	239	34 (15.23)	114	12 (10.53)	125	22 (17.60)
Hypertriglyceridemia ( $\geq 150$ mg/dl)	70	35 (50.00)	30	13 (43.33)	40	22 (55.00)	239	69 (28.87)	114	24 (21.05)	125	45 (36.00)
Hypoalphalipoproteinemia (HDL<40 mg/dl-male HDL<50 mg/dl-female)	70	48 (68.57)	30	14 (46.67)	40	34 (85.00)	239	186 (77.82)	114	78 (68.42)	125	108 (86.40)
LDL-C ( $\geq 130$ mg/dl)	66	21 (31.82)	26	8 (30.77)	40	13 (32.50)	232	44 (18.97)	103	21 (20.39)	121	23 (19.01)

Figures in parenthesis are percent prevalence. HDL: High-density lipoprotein, LDL-C: Low-density lipoprotein-cholesterol

study carried out by the ICMR at Ballabgarh (Haryana), Chennai (Tamil Nadu), Dibrugarh (Assam), Delhi, Nagpur (Maharashtra), and Thiruvananthapuram (Kerala) on risk factors for non-communicable diseases reported hypercholesterolemia as 18.1% and 23.4% among males and females in slums/periurban areas [14]. Similar findings were observed in our study where 14.6% males and 24.2% females had hypercholesterolemia. Another ICMR-India Diabetes study conducted in a representative population of three states of India, i.e., Tamil Nadu, Maharashtra, and Jharkhand and one Union Territory (Chandigarh) covering a population of 213 million people using stratified multistage sampling design to recruit individuals  $\geq 20$  years of age reported that 11.8% had high LDL-C levels, 72.3% had low HDL-C, 29.5% had hypertriglyceridemia, and 13.9% had hypercholesterolemia [15].

A study carried out among 14,215 non-hypertensive male Japanese workers (age  $38 \pm 9$  years) who were followed up for a median of 4 years to determine new-onset hypertension showed that elevated serum levels of TC were associated with an increased risk of hypertension [16]. Our study revealed a higher prevalence of hypercholesterolemia (38%), hypertriglyceridemia (60%), and high LDL-C (32%) among hypertensive compared to non-hypertensive adults (15%, 29%, and 19%, respectively). A study carried out among 161 adults in rural Nigeria also reported higher mean TC levels among hypertensive participants compared to non-hypertensive participants [17]. Another study carried out in Nigeria among 250 newly diagnosed hypertensive adults with age-matched controls revealed that hypertensive adults had significantly higher TC and TG [18]. A study carried out among Lebanese diabetic patients attending a tertiary healthcare clinic revealed that age older than 65 years, obesity, female gender as well as the presence of dyslipidemia are factors that were associated with hypertension prevalence [19].

## CONCLUSION

Hypertensive adults had higher BMI, serum cholesterol, TGs, and LDL-C compared to non-hypertensives.

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