Original Article

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High prevalence of prehypertension in mothers of young children in peri-urban Nepal

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Abstract

Background: Prehypertension is clinically defined as a level of blood pressure between normal and hypertension, i.e. elevated systolic blood pressure between120-139 or diastolic blood pressure between 80-89 mm Hg. Prehypertension remains neglectedas a public health problem, and has not been explored in mothers with small childrenin Nepal.

Objectives: We aimed to study prehypertensionand its related factors including obesity-related parameters among mothers with children aged 1-7 years in Duwakot and Jhaukhel communities of Bhaktapur district, Nepal.

Methods: We prepared a sampling frame of all the eligible mothers, and interviewed 962 mothers. The trained enumerators also measured their blood pressure, body weight, height, waist and hip circumferences.We analysed data with SPSS version 22. We received ethical approval from the Nepal Health Research Council to conduct the study, and obtained informed verbal consent from the participating mothers.

Results: About one-third (31.8%) of the mothers had prehypertension. It was more common among Newars and those aged 30-34 years. Multivariate analysis did not reveal significant association with sociodemographic variables except for education. We found positive correlations between blood pressure and obesity parameters.Overweight and obese participants were 2.24 (95% confidence interval: 1.06-4.73) and 4.65 (95% confidence interval: 1.92-11.23) times, respectively, more likely to have prehypertension than underweight mothers.

Conclusions: Our study demonstrated a high prevalence of prehypertension, coupled with high obesity parameters, among young mothers of peri-urban Nepal. Primordial preventive efforts at community level are needed not only for the mothers themselves, but for heart-health of their offspring as well.

Key words: Blood pressure, hypertension, obesity, prehypertension

INTRODUCTION

Prehypertension is defined as elevated systolic blood pressure (SBP)between120-139 or diastolic blood pressure (DBP) between 80-89 mm Hg, according to Joint National Committee (JNC) VII[1]. Globally, prehypertension affects 25-50% of the adult population[2], and 29% of adults of the South Asian region[3]. Although Nepal lacks official estimationof anational prehypertension prevalence, a meta-analysis based on a limited number of sub-national studies from Nepal estimates it to be 38%, which corresponds to the highest prehypertension prevalence in the South Asian region[3]. Indeed, elevated blood pressure is a rising public health problem in Nepal[4], with a quarter of the adults currently suffering from it[5].

Blood pressure as a continuous physiological variable demonstrates a linearly increased risk of adverse cardiovascular outcome[6]. In this regard, the prehypertensive population carries higher cardiovascular risk than normotensive people[2, 7], including incident hypertension[8]. In fact, almost one-third of women who are prehypertensive at baseline become hypertensive at

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the end of three years[9]. Further, prehypertensive people are more likely than those with normotension to have at least one other risk factor[10]. Indeed, high prevalence of prehypertension and other components of the metabolic syndrome have also been demonstrated in Nepal[11].

There are gender associated differences regarding blood pressure between men and women[12]. Although menhave higher blood pressure than women through much of their life, the prevalence of hypertension is predicted to increase more among women than menas the population ages[12,13,14]. Interestingly, more men (31.1%) in Nepal have hypertension than women (20.6%)[5] but gender-wise variation for prehypertension is not known. Nonetheless, a study on rural Nepalese women revealedthat 14.4% of them are prehypertensive[13].

Regarding women of reproductive age, especially young mothers, much of Nepal's public health attention has been on their nutritional and reproductive health issues[14, 15]. Unlike the common perception thatwomen are less likely to suffer from cardiovascular diseases (CVDs) including elevated blood pressure,a high prevalence of hypertension has been reported among young adult females[13, 16] and high blood pressure is a rising trend in this specific sub-population too[4].

Prehypertension, similar to hypertension, associates with various risk factors such as obesity, blood sugar level, and dyslipidemia[17,18]. Increased obesity parameters, both general and abdominal, are consistentlyrelated to higher prevalence of prehypertension[17-20]. Women in Nepal have high obesity parameters with approximately 22% and 5% being overweight and obese[5], especially in urban[21]and peri-urban[22] settings due to various factors including low physical activity[23].

To study population trends and perceptions on cardiovascular health in a peri-urban community, we started the Jhaukhel-Duwakot Health Demographic Surveillance Site (JD-HDSS) in the Bhaktapur district in 2010. Cardiovascular health emerged as an important but neglected issue in this community, particularly from the primary prevention perspective[22-24]. The aim of this paper was to specifically focus on mothers with children aged 1-7 years as mothersare the ones who are most involved in their children's behaviours related to cardiovascular risk factors including diet and physical activity[25]. We therefore estimated the extent of high blood pressure among mothers with emphasis on the concept of prehypertension and its association with obesity parameters.

METHODS

This is an observational cross-sectional study in JD-HDSS conducted in the Duwakot and Jhaukhel villages of Bhaktapur district, Nepal. We have previously reported the socio-demographic health status of these two adjoining communities[26].

SAMPLING AND SAMPLE SIZE

We developed a sampling frame of all mothers from Duwakot and Jhaukhel with children aged 1-7 years. In case there was more than one eligible mother in a household, the enumerator applied a lottery method to select one mother. Altogether, there were 962 mothers eligible for inclusioninto the study.

DATA COLLECTION

Trained enumerators visited mothers house-to-house, and interviewed them between September and December 2014. Enumerators also measured participants' blood pressure with Microlife digital devices; body weight with Microlife digital weighing machines; and anthropometric measurements (height, waist and hip circumferences) with non-stretchable measuring tapes. Blood pressure measurements were recorded three times in a gap of five minutes each. The average of three determinations was considered for data analysis. Blood pressure was classified according to JNC VII: normal<120 mmHg SBP and <80 mm Hg DBP; prehypertension : SBP between 120-139 or DBP between 80-89 mm Hg; and hypertension: ≥140 SBP or ≥ 90 mm Hg DBP or a known case of hypertension treated with lifestyle modification and/or anti-hypertensive medication[1]. Increased waist circumference (WC) and waist hip ratio (WHR) were set as≥ 80 cm[27] and ≥ 0.85[28], respectively.

We categorised socio-demographic variables as follows: age-group (<25, 25-29, 30-34, and ≥35years); religion (Hinduism and others); ethnicity (the three most common ones in the community: Newar, Brahmin and Chhetri, and other ethnic groups such as Tamang, Rai, Thakuri and Dalitwere grouped into 'others' because of similarities in socio-cultural traits); education (categorised as ≤grade 1 or less than primary,grade 1-5 or primary education, grade 6-10 or secondary education, and >grade 10 or higher secondary education or more); occupation (housewives; agriculture and labour were grouped into one as there is often an overlap; employee included those who are self-employed or working in a government or a private firm); type of family (nuclear and joint); and household monthly income (Nepali Rupees <10,000; 10,000-14,999; 15,000-19,999; and ≥20,000).

DATA ANALYSIS

We entered data in Epidata version 2.0 and analysed it with Statistical Package for Social Sciences (SPSS) version 22. We presented categorical data in numbers and percentages, and tested their associations in bivariate analysis with chi-square test. We used Pearson's correlation test for bivariate analysis of continuous variables. We have presented strengths of associations with unadjusted and adjusted odds ratios and their 95% confidence intervals. P<0.05 was considered statistically significant.

ETHICAL ASPECTS

The study received ethical approval from the Nepal Health Research Council (NHRC). We obtained informed verbal consent from the participating mothers and maintained confidentiality during data collection and data storage. Participants who were found to have elevated blood pressure were referred to Kathmandu Medical College Duwakot Hospital for counseling and treatment.

RESULTS

After excluding incompletely filled questionnaires, 916 mothers were included in the data analysis (Table 1). Mean age of the mothers was 29±4.6 years (range: 19-48). Most of them (88%) were ≤ 35 yearsold and 42% of them between 25-29 years. Ninety-two percent of them were Hindus. Most mothers belonged to the ethnic groups Chhetri (29%), Newar (28%) and Brahmin (22%). Twenty three percent of the participants had education level of less than grade 1, whereas 29% had studied up to grade 10 or beyond. Most mothers (73%) were housewives, while the rest were employed (17%) or doing agriculture or labour work (10%). Almost equal proportions of participants were living in nuclear (54%) and joint (46%) families. Information about monthly household income was available for 852 mothers. Of those, 11% had Nepal Rupees (NRP)< 10,000 while 42% had NRP≥ 20,000.

PREVALENCE OF ELEVATED BLOOD PRESSURE

Sixty percent of participants had normal blood pressure while the prevalence of prehypertension was 31.8%. Table 1 shows the prevalences according to various socio-demographic parameters. Ten mothers reported having been diagnosed with high blood pressure (10/916= 1.1%). Of these, six were on medication (6/10=60%). Of the six, only one had her blood pressure under control (1/6= 16.67%). Among the remaining 906 mothers, 69 were found to have high blood pressure during the survey (69/916= 7.5%). Hence, the prevalence of high blood pressure was 8.6% (1.1%+7.5%), and out of a total of 79 hypertensive mothers, only 10 knew that they had hypertension (awareness rate:12.65%).

RELATIONSHIP OF PREHYPERTENSION WITH SOCIO-DEMOGRAPHIC FACTORS

Prehypertension was more common in the 30-34 years age group (37.9%) and among Newars (38.5%)(Table 1). After adjusting for possible confounders, those with lowest education (≤grade 1) had 1.62 (95% CI: 1.04-2.5) times higher odds of having prehypertension compared to those with highest education (>grade 10) (Table 2). There were no significant associations for other sociodemographic variables.

ASSOCIATION OF PREHYPERTENSION WITH OBESITY PARAMETERS

We found a positive relationship between BMI and blood pressure status (Pearson correlation for SBP: 0.280, p<0.001; for DBP: 0.228, p<0.001). This was additionally reflected in the prevalence of prehypertension, with 55% of obese mothers having prehypertension compared to only 20% of underweight mothers (Table 3). Overweight and obese mothers were 2.24 (95% CI: 1.06-4.73) and 4.65 (95% CI: 1.92-11.23) times, respectively, more likely to have prehypertension than underweight mothers (Table 3).

Likewise, waist circumference exhibited a positive correlation both with SBP (Pearson correlation: 0.255, p<0.001) and DBP (Pearson correlation: 0.243, p<0.001). Those with increased waist circumference were 2.27 (95% CI: 1.56-3.30) times higher odds of having prehypertension than mothers with normal waist circumference (Table 3). There was a weak positive correlation between waist hip ratio and blood pressure (Pearson correlation for SBP: 0.131, p<0.001, and DBP: 0.190, p<0.001). Mothers with increased waist hip ratio had 1.52 (95% CI:1.12-2.05) higher odds of having prehypertension (Table 3).

Table 1: Blood pressure status of the study population according to their socio-demographic background

	Blood pressure status						Total		p-value
	Normal		Prehypertension		Hypertension				
	N	%	N	%	N	%	N	%	
Age (years)									
<25	100	68.0	40	27.2	7	4.8	147	100.0	0.018
25-29	242	63.9	109	28.8	28	7.4	379	100.0	
30-34	148	54.4	103	37.9	21	7.7	272	100.0	
≥ 35	56	51.9	39	36.1	13	12.0	108	100.0	
Religion									
Hindu	501	60.1	272	32.6	61	7.3	834	100.0	0.347
Non-Hindu[a]	45	62.5	19	26.4	8	11.1	72	100.0	
Ethnicity									
Newar	136	52.9	99	38.5	22	8.6	257	100.0	0.022
Brahmin	142	69.3	53	25.9	10	4.9	205	100.0	
Chhetri	157	58.8	85	31.8	25	9.4	267	100.0	
Others[b]	111	62.7	54	30.5	12	6.8	177	100.0	
Education									
<Grade 1	113	54.9	70	34.0	23	11.2	206	100.0	0.105
Grade 1- 5	157	60.4	83	31.9	20	7.7	260	100.0	
Grade 6- 10	103	57.5	65	36.3	11	6.1	179	100.0	
≥Grade 10	173	66.3	73	28.0	15	5.7	261	100.0	
Occupation									
Agriculture/labour	54	57.4	32	34.0	8	8.5	94	100.0	0.300
Employee	102	66.2	46	29.9	6	3.9	154	100.0	
Housewife	390	59.3	213	32.4	55	8.4	658	100.0	
Type of family									
Joint	252	60.7	136	32.8	27	6.5	415	100.0	0.505
Nuclear	294	59.9	155	31.6	42	8.6	491	100.0	
Household's monthly income (NRs)[c]									
<10 000	59	61.5	30	31.3	7	7.3	96	100.0	0.630
10 000 - 14 999	141	61.3	71	30.9	18	7.8	230	100.0	
15 000 - 19 999	103	60.9	51	30.2	15	8.9	169	100.0	
≥20 000	214	59.9	125	35.0	18	5.0	357	100.0	

[a]Non-Hindu included Buddhists, Muslims and Christians[b] Others included *Tamangs, Rais, Thakuris, Dalits*,etc

[c]Nepali Rupees (1 US dollar equivalent to approx. NRs. 108)

Table 2: Odds ratios of having prehypertension in comparison to those with normal blood pressure according to different socio-demographic factors

	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Age (years)[a]		
≥ 35	1.74 (1.01-3.02)	1.59 (0.91-2.79)
30-34	1.74 (1.11-2.71)	1.69 (1.07-2.67)
25-29	1.17 (0.73-1.73)	1.09 (0.71-1.70)
<25	ref	ref
Religion[a]		
Hindu	1.29 (0.74-2.24)	1.23 (0.67-2.26)
Non-Hindu	ref	ref
Ethnicity[a]		
Newar	1.49 (0.98-2.27)	1.34 (0.84-2.14)
Brahmin	0.76 (0.49-1.20)	0.67 (0.39-1.14)
Chhetri	1.11 (0.73-1.69)	0.99 (0.62-1.60)
Others	ref	ref
Education[a]		
<Grade 1	1.47 (0.98-2.20)	1.62 (1.04-2.52)
Grade 1- 5	1.25 (0.85-1.83)	1.334 (0.897-1.985)
Grade 6- 10	1.49 (0.99-2.26)	1.501 (0.982-2.294)
≥Grade 10	ref	ref
Occupation[a]		
Agriculture/labour	1.08 (0.68-1.73)	0.99 (0.60-1.62)
Employee	0.83 (0.56-1.21)	0.80 (0.53-1.21)
Housewife	ref	ref
Type of family[a]		
Joint	1.024 (0.770-1.361)	1.035 (0.765-1.401)
Nuclear	ref	ref
Household's monthly income (NRs.)[a]		
≥20 000	1.149 (0.703-1.878)	1.329 (0.792-2.232)
15 000 - 19 999	0.974 (0.560-1.693)	1.043 (0.593-1.833)
10 000 - 14 999	0.990 (0.586-1.672)	1.055 (0.619-1.797)
<10 000	ref	ref

ref: reference category; CI: confidence interval

[a]odds ratios for age, religion, ethnicity, education, occupation, type of family and household monthly income were adjusted for socioeconomic variables other than the dependent variable itself.

Table 3: Blood pressure status of the study population according to their obesity parameters

	Blood pressure status						Total		Odds Ratio (95% confidence interval)of having prehypertension in comparison to having normal blood pressure		p-value
	Normal		Prehypertension		Hypertension						
	N	%	N	%	N	%	N	%	Unadjusted	Adjusted[d]	
Body Mass Index[a]											
Underweight	35	71.4	10	20.4	4	8.2	49	100.0	ref	ref	<0.001
Normal	323	67.3	128	26.7	29	6.0	480	100.0	1.39 (0.67-2.89)	1.286 (0.615-2.686)	
Overweight	164	52.6	117	37.5	31	9.9	312	100.0	2.49 (1.19-5.24)	2.238 (1.06-4.73)	
Obese	24	36.9	36	55.4	5	7.7	65	100.0	5.250 (2.19-12.56)	4.65 (1.92-11.23)	
Waist circumference											
Normal	476	64.0	215	28.9	53	7.1	744	100.0	ref	ref	<0.001
Increased [b]	70	43.2	76	46.9	16	9.9	162	100.0	2.40 (1.67-3.45)	2.27 (1.56-3.30)	
Waist hip ratio											
Normal	379	63.9	174	29.3	40	6.7	593	100.0	ref	ref	0.008
Increased [c]	167	53.4	117	37.4	29	9.3	313	100.0	1.53 (1.13-2.05)	1.51 (1.12-2.05)	

[a] Body mass index classified according to WHO classification (ref); [b] ≥80 cm; [c] ≥ 0.85
[d]adjusted for socioeconomic variables

DISCUSSION

Our study demonstrated high prevalence (one-third) of prehypertension among peri-urban Nepalese mothers with young children. This prevalence is similar to that of Bangladeshi[29] and Iranian women[30]; lower than the prevalence in rural women of West Bengal in India (40.8%)[31]; and higher than that of Jamaican women (25%)[32]. Similar high prevalence has earlier been reported in Nepalese women from hill origin[13], and most of our mothers also belong to the same geographic background. In particular, mothers belonging to the Newari community in our study had high prevalence (38.5%) of prehypertension, a finding also reported earlier for the general population in the same community[33].

Mothers belonging to thehigher age group in our study had higher prevalence of prehypertension, a phenomenon which is seen in all populations[1]. Of concern is the fact that even among those who are younger than 25 years, more than a quarter of them hadprehypertension. This high occurrence of prehypertension in the relatively younger age group has been reported in North India too[34]. Unlike the previous Nepalese study[13], mothers with higher income in our study had marginally higher prevalence of prehypertension (35% vs. 31%).

Our study specifically aimed to investigate the association between obesity parameters and prehypertension. More than a third of overweight mothers and more than half of obese mothers had prehypertension. The positive association between body weight and blood pressure is an establishedone[35]. This is of specific concern in these young mothers because there is high prevalence of overweight (one-third) and obesity (7%) in these mothers- higher than the national average for women of similar age range[5].

Health-care providers as well as the general population often have the misconception that blood pressure in the prehypertension range does not require intervention, and that people can continue with their lifestyle including dietary and physical activity behaviours[36-39]. Failure to adapt proper health behaviour if having prehypertension maylead to full-fledged hypertension and a greater difficulty to implement necessary lifestyle changes[39-41]. In fact, we reported earlier that there is a tendency among mothers in our peri-urban study setting to act, particularly in relation to diet and physical activity, only when they have been diagnosed as having a disease, including high blood pressure[24]. Therefore, it is important to communicate the significance of prehypertension at the population level. Those who are prehypertensive must be firmly and unambiguously advised to practice lifestyle modification to reduce their risk of developing hypertension in the future[42]. This is particularly true for the mothers in our study, because maintaining an unhealthy lifestyleis likelyto not only adversely affect their own health but may also negatively influence their children's choices regarding diet and physical activity[25].

Our study has some limitations. We did not ask the participants about other risk factors that could affect their blood pressure statussuch as smoking and alcohol behaviour[17, 43]. Surprisingly, smoking was not associated with prehypertension in another Nepalese study on rural Nepalese women[13]. Furthermore, we did not inquire if participants were aware of their pre-pregnancy blood pressure. This would have provided the opportunity to explorethe possibility of pregnancy-induced high blood pressure, as many of the mothers may have continued to have chronic hypertension after developing pregnancy-induced hypertension. Indeed, similar to hypertension[44], prehypertension also leads to adverse pregnancy and neonatal outcomes[45, 46]. Hypertensive disorders of pregnancy are in fact the second commonest cause of maternal mortality in Nepal[47], and this further underscores the importance of blood pressure control in Nepalese women. Because 86% of Nepalese pregnant women havetheir blood pressure measured during the antenatal visit[14], extending counselling for those with prehypertension could be a cost-effective public health intervention[48]. For the women residing in Duwakot and Jhaukhel, screening during pregnancy could be a good entry point for blood pressure counselling as almost all (97%) of them have at least one antenatal visit[26]. As Nepal faces many challenges forblood pressure prevention and control[49], paying attention to prehypertension could also be a useful addition to the ongoing preventive efforts focused on cardiovascular diseases.

CONCLUSION

Our study demonstrated a high prevalence of prehypertension in the peri-urban mothers of young children, particularly in the background of high obesity parameters, indicating need for primordial preventive efforts at community level that address behavioural cardiovascular risk factors. This is important not only for the mothers themselves, but for heart-health of their offspring as well.

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