ORIGINAL RESEARCH PAPER | Home Science | Volume : 6 | Issue : 9 | September 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50

BMI, Waist to Hip Ratio, Body Fat and Blood Pressure of Urban Women From Low and Lower Middle Income Group

KEYWORDS: urban women, BMI, blood pressure, WHR, body fat

Monica G. Oak
Ph.D Scholar, Department of Food Science and Nutrition, S.N.D.T. Women's University, Juhu Road, Mumbai - 400049, Maharashtra, India.

Padmini Ghugre
Associate Professor, Department of Food Science and Nutrition, S.N.D.T. Women's University, Juhu Road, Mumbai - 400049, Maharashtra, India.

ABSTRACT *India is witnessing rapid urbanization and improvement in economy. Consumption of energy is increasing along with decreasing physical activity. As a result, incidence of non communicable diseases (NCDs) is on rise. Objective of the present study is to examine the prevalence of obesity and hypertension among women (n=1500) belonging to low and lower middle income group residing in slums in Mumbai. Our study reported that 58.8% women from low and lower middle income group were overweight and obese. It is also observed that 43.4% women were pre-hypertensive and 12.8% were hypertensive. Age was positively and significantly associated with body mass index, waist to hip ratio, waist circumference, body fat, systolic and diastolic blood pressure. It is concluded that women from low and lower middle socioeconomic status in India show the increasing prevalence of overweight and obesity and are at risk of non communicable diseases. Therefore there is need for intervention.*

Introduction:
Globally, there have been major shifts in dietary and physical activity pattern (Popkin and Gordon-Larsen, 2004) with concurrent increase in NCDs (Non-Communicable Diseases). India is also witnessing urbanization, rural to urban migration as well as improvement in socioeconomic status. This transition is associated with substitution of coarse grains with highly polished cereals, increased intake of fat, sugar, foods of animal origin and other processed foods (Vaz et. al., 2005). Reports reveal that between 1973 and 2004, there has been 7% reduction in energy derived from carbohydrates and 6% increase in energy derived from fats. (Misra et. al., 2011) Also, increased mechanization (Misra et. al., 2011), motorized transport, reduced physically demanding tasks at home and in the workplace (Kapil et. al., 2012) across socioeconomic status have all resulted in decreased physical activity. Obesity is no more a condition related to affluence but it is seen in poorer sections also (Subramanian 2006). Rates of obesity are high among women. Prevalence of overweight and obesity in Indian women was 14.8% in 2006. Obesity increases the risk of number of NCDs including hypertension. In 2004-05, prevalence of adult hypertension was between 20-40 percent in urban areas and 12-17 percent in rural areas in India (Mohan et al, 2013). Age adjusted prevalence of hypertension was 31.5% rural women and 48.2% in urban women in India (Gupta et al, 2012). Health care cost for NCDs has increased tremendously and represent a large component of GNP (Gross National Product). This in turn may slow down the economic growth of the country (Popkin, 2006). Thus objective of the present study is to examine the prevalence of obesity and hypertension among women belonging to low and lower middle income group residing in slums in the Mumbai city in order to develop preventive strategy.

Methodology:
The study was approved by Independent Ethics Committee, Navi Mumbai. Fifteen hundred women (20-45 years age) from low or lower middle income group residing in Mumbai who were willing to participate in the study were recruited after obtaining written informed consent in local language. Women on prolonged medication, suffering from chronic disease and those who were pregnant or lactating were excluded.

Anthropometric measurements:
Height and, waist (WC) and hip circumferences (HC) were measured accurately using non stretchable, flexible measuring tape to nearest 0.1 cms. (Fidanza & Keller, 1991) The tape was calibrated against a stadiometer (GPM; Swiss Mada) in the laboratory.

Women were weighed with light clothing on an electronic digital weighing scale (Equinox Model EB6171) with an accuracy of 0.1 kg (Fidanza & Keller, 1991). Weighing scale was calibrated against standard weights.

Skinfolds were measured at biceps, triceps, (Jelliffe, 1966) subscapular and suprailiac sites (Durnin et al, 1973) using Harpenden calipers (Baty International, RH159LB, England).

All the anthropometric measurements were recorded in triplicate and mean was used for analysis. All anthropometric measurements were carried out on right side of the participant's body.

Body mass index (BMI) was calculated and women were classified according to BMI cutoffs for Asians given by WHO (2004). Body fat percentage was calculated from sum of skinfolds (Durnin, 1973). For Waist to Hip ratio (WHR) and total body fat, cutoffs given by WHO (2000) and Misra et al (2003) were used respectively.

Blood pressure (BP) was measured using manual mercury sphygmomanometer (Diamond, BPMR-120 Mercurial BP Delux) on the right arm. Systolic and diastolic blood pressure measurements (SBP and DBP) were taken using auscultatory method. Blood pressure cutoffs given by James et al (2014) were used.

Statistical analyses were carried out using IBM SPSS statistics software version 20. Descriptive statistics were calculated for all the measurements. Chi square test was used for association between BP categories and BMI categories and; WHR categories and BMI categories. Linear regression was used to assess the association of BMI and age with SBP and DBP.

Volume : 6 | Issue : 9 | September 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50

Results:
Table 1 gives means for all the anthropometric measurements. Mean WHR corresponded to normal category. However, mean BMI and mean body fat fell into categories higher than normal.

Table 1: Mean Anthropometric measurements of subjects (n = 1500)

	Minimum	Maximum	Mean± SD	95% CI
Age (years)	21	45	32.98± 7.27	32.61-33.35
Mean Height (cms)	131	176	152.69± 6.025	152.39-153.00
Mean Weight (kgs)	30.3	117.80	57.4459± 12.52	56.84-58.11
Mean BMI	14	50.99	24.65± 5.22	24.39-24.92
Mean WC (cms)	54.4	121.30	76.98± 11.04	76.42-77.54
Mean HC (cms)	66	151.10	97.85± 10.83	97.30-98.39
Mean WHR	0.57	1.28	0.79± 0.06	0.78-0.79
Mean Body fat (%)	13.30	48.57	30.99± 6.18	30.68-31.30
Mean systolic BP (mmHg)	82	205	119.20± 15.02	118.44-119.96
Mean diastolic BP (mmHg)	48	156	80.13± 11.26	79.56-80.70

Figure 1 explains distribution of women according to BMI categories. More than half of the women had BMI greater than normal.

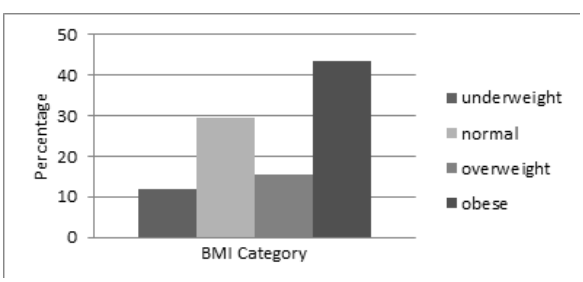

Figure 1: Distribution of women according to BMI

WHR was normal in 59.4% subjects and high (> 0.8) in the remaining subjects. In all, 63.5% subjects had normal WC (< 80 cms). Body fat percentage fell in normal category for 40.5%, remaining subjects had high body fat percentage. 43.9% subjects were normotensive, 43.4% subjects were pre-hypertensive, 7.3% subjects were stage I hypertensive and 5.5% subjects were stage II hypertensive.

Age was positively and significantly associated with BMI (P=0.00, r=0.285), WHR (P=0.00, r=0.208), WC (P=0.00, r=0.307) and body fat (P=0.00, r=0.254). Also age was significantly associated with SBP (P=0.00, r=0.416) and DBP (P=0.00, r=0.389). Every unit increase in age was associated with increase in DBP by 0.42 mmHg and increase in SBP by 0.64 mmHg.

Further, WHR and BP were examined according to BMI categories (Table 2).

Table 2: Distribution of WHR and BP according to BMI

		WHR% (N)		Blood Pressure % (N)			
	BMI Category (N)	Normal	High	Normotensive	Pre-hypertensive	Stage I hypertensive	Stage II hypertensive
BMI	Underweight (177)	148 (83.6)	29 (16.4)	148 (83.6)	26 (14.7)	3 (1.7)	0 (0.0)
	Normal (439)	318 (72.4)	121 (27.6)	266 (60.6)	150 (34.2)	17 (3.9)	6 (1.4)
	Overweight (230)	123 (53.5)	107 (46.5)	82 (35.7)	125 (54.3)	21 (9.1)	2 (0.9)
	Obese (654)	302 (46.2)	352 (53.8)	162 (24.8)	350 (53.5)	68 (10.4)	74 (11.3)
χ^2		124.74		311.09			
P value		0.00		0.00			

Percent subjects with higher WHR increased with increasing BMI. However, about half of obese had normal WHR. Percentage of normotensive has decreased with increasing BMI category. When age was controlled, every unit increase in BMI was associated with increase in DBP by 0.89 mmHg and with SBP by 1.09 mmHg.

Discussion:
In the present study, we observed that almost 58.8% of the women from low and lower middle income group were overweight and obese. According to NFHS 4 data for urban Maharashtra, percentage of overweight and obese women was 32.4% (BMI ≥ 25) and 34% in Mumbai had BMI greater than 25. On comparison of NFHS 3 and NFHS 4 data, there was increase in percentage of overweight and obesity in women from urban Maharashtra from 27.4 to 32.4. It appears that prevalence of overweight and obesity is increasing over the last decade in India. Similar trends have been reported worldwide. According to WHO Global Health Observatory data, the prevalence of overweight and obesity among women increased from 8% in 1980 to 14% in 2008. In US, overall age adjusted prevalence of abdominal obesity increased significantly from 46.4% in 1999 to 54.2% in 2011-2012 (Ford et al, 2014). Increased prevalence of overweight and obesity in women can be attributed by increased fat and energy intake. Intake of fat has increased by 11.5 gms and intake of energy has increased by 113 Kcal from 1973 to 2005 in urban India (Misra et al, 2011). Due to motorized transport and increased mechanization, physical activity has declined (Kapil and Sachdev, 2012). This in addition with increasing intake of high calorie foods is resulting in positive energy balance which is the possible reason for higher percentage of overweight and obesity in present study. So there is need of integrated sustainable strategies to reverse the trend.

Further our study revealed that 43.4% of the subjects were pre-hypertensive and 12.8% were hypertensive. Joshi et al (2012) reported that overall prevalence of hypertension was 46%. In Maharashtra, the percentage was 56.4 for hypertension and 58.6 for prehypertension. The latter being comparable to the value obtained in the present study. Although the percentage of hypertensive women was low in the present study, pre-hypertension was high. In view of increased percentage of obesity in this group, the risk of pre-hypertensive becoming hypertensive is very high, if adequate preventive measures are not taken. Our study also revealed positive correlation between BMI and BP. Dua et al (2014) found significant positive correlation between

Volume : 6 | Issue : 9 | September 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50

BMI and BP among adults (18-50 years) in urban India. Mungreiphy et al (2011) has also reported similar correlation in Tangkhul Naga tribal males of Northeast India. Similar trends have been reported in other countries including Ethiopia, Vietnam and Indonesia (Tesfaye et al, 2007), Korea (Jones et al, 1994) and the US (Brown et al, 2000). Among Koreans, each BMI unit was associated with a difference of 1 mmHg in DBP in high BMI category and 0.89 mmHg in DBP in normal BMI category (Jones et al, 1994). Increase in BMI increases the risk of hypertension.

In the present study, significant positive correlation was found between SBP, DBP and the age. Also significant positive correlation was found between age and BMI. Age is an independent risk factor for increase in blood pressure. Age was strongly correlated with arterial parameters at the site of carotid artery (Benetos et al, 1993). The Baltimore study of Ageing reported that the rates of PWV (Carotid-femoral pulse wave velocity, a marker of arterial stiffness) increased with increasing age (AlGhatrif et al, 2013). These arterial changes may be contributing for increase in blood pressure with increasing age. Further age associated increase in weight will have a compounding effect.

Women from low and lower middle socioeconomic status in India show the increasing prevalence of overweight and obesity and are at risk of NCDs. If this continues, burden of NCDs will further increase. Therefore, there is need for intervention in terms of creating lifestyle awareness and proper diagnosis and treatment of NCDs.

Acknowledgement:
We acknowledge the University Grants Commission for financial assistance.

References:

1. AlGhatrif, M., Strait, J.B., Morrell, C.H., Canepa, M., Wright, J., Elango, P., Scuteri, A., Najjar, S.S., Ferrucci, L., Lakatta, E.G. (2013). Longitudinal trajectories of arterial stiffness and the role of blood pressure: the Baltimore Longitudinal Study of Aging. *Hypertension*, 62(5), 934-41.
2. Benetos, A., Laurent, S., Hoeks, A.P., Boutouyrie, P.H., Safar, M.E. (1993). Arterial alterations with aging and high blood pressure. A noninvasive study of carotid and femoral arteries. *Arterioscler Thromb*, 13(1), 90-7.
3. Brown, C.D., Higgins, M., Donato, K.A., Rohde, F.C., Garrison, R., Obarzanek, E., Ernst, N.D., Horan, M. (2000). Body mass index and the prevalence of hypertension and dyslipidemia. *Obes Res*, 8(9), 605-19.
4. Dua, S., Bhuker, M., Sharma, P., Dhall, M., Kapoor, S. (2014). Body mass index relates to blood pressure among adults. *North Am J Med Sci*, 6, 89-95.
5. Durnin, J.V.G.A., Womersley, J. (1973). Body Fat Assessed From Total Body Density and Its Estimation From Skinfold Thickness: Measurements on 481 Men and Women Aged From 16 to 72 Years. *Br J Nutr*, 32, 77-97.
6. Fidanza, F., Keller, W. (1991) Nutritional Status Assessment - A Manual for Population Studies. London: Champman & Hall.
7. Ford, E.S., Maynard, L.M., Li, C. (2014). Trends in mean waist circumference and abdominal obesity among US adults, 1999-2012. *JAMA*, 312(11), 1151-3.
8. Gupta, R., Pandey, R.M., Misra, A., Agrawal, A., Misra, P., Dey, S., Rao, S., Menon, V.U., Kamalamma, N., Vasantha Devi, K.P., Revathi, K., Vikram, N.K., Sharma, V., Guptha, S. (2012). High prevalence and low awareness, treatment and control of hypertension in Asian Indian women. *J Hum Hypertens*, 26(10), 585-93.
9. James, P.A., Oparil, S., Carter, B.L., Cushman, W.C., Dennison-Himmelfarb, C., Handler, J., Lackland, D.T., LeFevre, M.L., MacKenzie, T.D., Ogedegbe, O., Smith, S.C.Jr., Svetkey, L.P., Taler, S.J., Townsend, R.R., Wright, J.T.Jr, Narva, A.S., Ortiz, E. (2014) evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *JAMA*, 311(5), 507-20. doi: 10.1001/jama.2013.284427.
10. Jelliffe, D.B. (1966). The Assessment of the Nutritional Status of the Community. Geneva: WHO.
11. Jones, D.W., Kim, J.S., Andrew, M.E., Kim, S.J., Hong, Y.P. (1994). Body mass index and blood pressure in Korean men and women: the Korean National Blood Pressure Survey. *J Hypertens*, 12(12), 1433-7.
12. Joshi, S.R., Saboo, B., Vadivale, M., Dani, S.I., Mithal, A., Kaul, U., Badgandi, M., Iyengar, S.S., Viswanathan, V., Sivakadaksham, N., Chattopadhyaya, P.S., Biswas, A.D., Jindal, S., Khan, I.A., Sethi, B.K., Rao, V.D., Dalal, J.J., SITE Investigators. (2012). Prevalence of diagnosed and undiagnosed diabetes and hypertension in India--results from the Screening India's Twin Epidemic (SITE) study. *Diabetes Technol Ther*, 14(1), 8-15. doi:10.1089/dia.2011.0243.
13. Kapil, U., Sachdev, H.P. (2012). Urgent Need to Orient Public Health Response to Rapid Nutrition Transition. *Indian Journal of Community Medicine*, 37(4), 207-210.
14. Misra, A., Pandey, R.M., Sinha, S., Guleria, R., Sridhar, V., Dudeja, V. (2003) Receiver operating characteristics curve analysis of body fat & body mass index in dyslipidaemic Asian Indians. *Indian J Med Res*, 117, 170-9.
15. Misra, A., Shinghal, N., Sivakumar, B., Bhagat, N., Jaiswal, A., Khurana, L. (2011). Nutrition Transition in India: Secular Trends in Dietary Intake and Their Relationship to Diet-Related Non-Communicable Diseases. *Journal of diabetes*, 3, 278-292.
16. Mohan, S., Campbell, N., Chockalingam, A. (2013). Time to effectively address hypertension in India. *Indian J Med Res*, 137, 627-631.
17. Mungreiphy, N.K., Kapoor, K., Sinha, R. (2011) Association between BMI, blood pressure, and age: study among Tangkhul Naga tribal males of Northeast India. *Journal of Anthropology*. doi:10.1155/2011/748147
18. National Family Health Survey (2005-06) State factsheet- Maharashtra. Retrieved from: http://rchiips.org/nfhs/pdf/Maharashtra.pdf
19. National Family Health Survey (2015-16) State factsheet- Maharashtra. Retrieved from: http://rchiips.org/nfhs/pdf/NFHS4/Maharashtra.pdf
20. National Family Health Survey (2015-16) District factsheet- Mumbai. Retrieved from: http://rchiips.org/nfhs/FCTS/MH/Mumbai.pdf
21. Popkin, B.M. (2006). Global Nutrition Dynamics: The World is Shifting Rapidly Toward a Diet Linked with Non-communicable Diseases. *Am J Clin Nutr*, 84, 289-98.
22. Popkin, B.M., & Gordon-Larsen, P. (2004). The nutrition transition: worldwide obesity dynamics and their determinants. *Int J Obes Relat Metab Disord*, 28 (Suppl 3), S2-9.
23. Subramanian, S.V., Smith, G.D. (2006). Patterns, distribution, and determinants of under- and overnutrition: a population-based study of women in India. *Am J Clin Nutr*, 84(3), 633-40.
24. Tesfaye, F., Nawi, N.G., Van Minh, H., Byass, P., Berhane, Y., Bonita, R., Wall, S. (2007) Association between body mass index and blood pressure across three populations in Africa and Asia. *J Hum Hypertens*, 21(1), 28-37.
25. Vaz, M., Yusuf, S., Bharathi, A.V., Kurpad, A.V., Swaminathan, S. (2005) The Nutrition Transition in India. *South Asian Journal of Clinical nutrition*, 18(2), 198-201.
26. WHO Expert Consultation. (2004) Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet*, 363(9403), 157-63.
27. WHO, Global health observatory data. Obesity- Situation and Trends. Retrieved from: http://www.who.int/gho/ncd/risk_factors/obesity_text/en/
28. World Health Organization (2000) The Asia Pacific Perspective. Redefining Obesity and Its Treatment. Retrieved from: http://wpro.who.int/nutrition/documents/docs/Redefiningobesity.pdf