ORIGINAL ARTICLE

Adiposity and hypertension associated risk factors in young (<40 yr) urban industrial men from Pune, India

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Abstract | Introduction | Methodology | Results | Conclusion | References | Citation | Tables / Figures

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Abstract

Background: Prevalence of hypertension is not only on the rise in urban population, but its precedence is of concern. **Aims & Objective:** To identify risk factors associated with hypertension among urban young Indian males. (<40yr). **Material & Methods**: Young males (<40yr) working in Hinjewadi industrial area of Pune, Maharashtra were studied (n=254) for anthropometry, blood pressure and diet, lifestyle, and stress at work. **Results**: Prevalence of overweight was 72.5% and 48.4 % were obese while 38.2% were centrally obese (WC□90). Prevalence of hypertension (HTN) was high (25.6%) and showed significant association only with BMI. Non vegetarian diet was a risk factor (OR-1.94;p<0.05) for overweight while lifestyle factors increased risk for obesity (OR-2.1;p<0.05) as also central obesity (OR-1.91;p<0.05). Among subjects with high BMI, these factors became non-significant and stress alone showed independent influence on HTN (OR-4.43; p<0.05) indicating that their influence was mediated through adiposity. **Conclusion:** Promoting good dietary practices, healthy lifestyle and better work environment for reducing obesity and consequent risk of NCDs among young urban males is essential in India.

Keywords

Hypertension; Risk Factors; Young Urban Males

Introduction

Obesity is now being identified as a major public health problem, both in the developed as well as in the developing countries. Parallel to obesity, abdominal obesity is also on the rise all across the world, especially increasing at a rapid rate among the developing countries, thus aggravating the existing health burden (1). In particular, India is passing through nutritional transition and changes in diet and activity patterns along with a sedentary lifestyle are prime components of this transition and this in turn has reflected in the high prevalence of non communicable diseases (NCD) in urban India (2,3). Considerable increase in the prevalence of hypertension from 11% to 40-50% (4,5) and more importantly the precedence of its onset in younger ages among Indians is a cause of concern. Additionally, studies also have reported (6,7) higher prevalence of NCDs among men as compared to women. It thus becomes evident that it is the urban affluent male population that is particularly at a high risk of developing NCDs associated with obesity and abdominal obesity. Therefore, identifying risk factors associated with obesity and consequently with high

blood pressure is critical as it forms the basis of developing guidelines for preparation and implementation of appropriate preventive interventions.

Despite substantial evidence to demonstrate that abdominal obesity is much higher than overall obesity in urban Indian population (4,8) and that abdominal fat is a more potent risk factor for NCDs independent of total adiposity (9,10) there have been very few attempts to estimate visceral fat and examine its association with NCDs. Studies focusing on younger age groups are scares as most reported Indian studies cover a wide age range (up to 60 or 70 yrs). Further, majority of the studies have interest in reporting prevalence (11,12) and relate it to the most obvious factor i.e. adiposity but overlook the relative importance of other factors like diet, lifestyle, stress and physical activity which are major contributors to NCD risk. In fact, there are very few studies which investigate whether these factors have independent influence or their effect is mediated through adiposity in predicting the NCD risk. The present paper attempts to address these issues especially among young urban male adults from Pune, India.

Aims & Objectives

1. To identify risk factors associated with hypertension among urban young Indian males. (<40yr).
2. To examine whether factors like diet, lifestyle factors and stress have independent influence or whether their influence is mediated through adiposity in predicting risk of hypertension.

Material & Methods

Subjects: The present study adopted a cross-sectional design. In recent years focus of Pune city has changed along with education as an employment source city due to increased information technology (IT) and Non IT industries. A medical centre in Hinjewadi industrial area of Pune which had link ups with various companies was contacted. After explaining format and purpose of study, the participants recruited gave an informed written consent. Since study was intended to include young adult population, age group was limited to 25-45 yrs. The ethical clearance for the study protocol was sought from School of Health Science of the University. Data were collected on 254 males.

Measurements - Anthropometric measurements were recorded using standard procedures. A rigid, Secca stadiometer was used for measurement of height with least count of 0.1 cm. A digital Omron Fat analyser HBF 362 (Omron Health care Co., Kyoto, Japan) was used for compiled measures of body weight and visceral fat% (VF). Body Mass Index (BMI) was computed as the ratio of weight (kg) to square of height in meters. Waist circumference (WC) was measured at the midpoint between the lower borders of the ribcage.

Blood pressure measurement was taken by a medical practitioner using Mercury Sphygmomanometer kept at heart level of participants. The second measurement was taken after making person rest for 5 minutes and average was used for analysis. Appropriate adult sized cuff was used to measure blood pressure. Two readings were recorded and the second reading was used in the analysis. Measurements were recorded by two medical doctors.

Qualitative information - Detailed socio-economic information was collected using a structured questionnaire which comprised of socio-demographic variables such as age, marital status, family type and education, income, economic assets such as ownership of house and four wheeler, whether the spouse also works etc. Information on various aspects in relation to hypertension was collected. Firstly, dietary habits such as whether a subject is vegetarian or non-vegetarian; takes breakfast at canteen or outside; lunch is brought from home or taken at the canteen or goes out; whether the subject needs extra salt and usual level of salt taken etc were asked. Secondly, life style factors like smoking its frequency and duration, alcohol consumption and its frequency were enquired. Whether the subject gets a normal sleep or has a disturbed sleep was also asked. Finally, some information was also sought regarding stress at work. These questions sought information on his relation with Boss is friendly or otherwise; whether his job involves frequent travel, whether it involves shifts and whether the subject feels any job insecurity.

Scoring of qualitative information: For adjusting the effects of confounders such as stress, life style factors and diet their scores were computed and used in the analysis. Scores were computed considering binary categories of variables in each of these factors. For example, life style factor score was computed considering smoking (no=1, yes=2), alcohol consumption (no=1, yes=2) and sleep (normal=1, disturbed =2) and adding the scores. Similarly, score for stress was computed considering stress at work (no=1, yes=2); relation with Boss (friendly=1, not friendly =2); job shift (no=1, yes=2); frequent travel (no=1, yes=2); job insecurity (no=1, yes=2; work in IT company (no=1, yes=2); goes to work on two wheeler (no=1, yes=2) and adding the scores while that for diet was computed as for vegetarian =1 and for non-vegetarian =2.

Definitions- BMI was used to assess overweight (≥23 kg/m^2) and obesity (≥25 kg/m^2) according to revised WHO criteria for Asians (13). Abdominal obesity was assessed according to the revised (14) ethnic specific cut offs for WC (≥90 cm). Hypertension (HTN) was defined as blood pressure ≥140/90 mmHg or if the subject was taking anti-

hypertensive medication according to the report of JNC VII (15). Similarly, high systolic blood pressure (HSBP) was defined as systolic blood pressure ≥ 140 mmHg and high diastolic blood pressure (HDBP) was defined as diastolic blood pressure ≥ 90 mmHg.

Statistical Methods- Variables were checked for normality and were transformed if deviated. BMI and VF was thus log transformed to achieve normality. Continuous variables are reported as mean ± SD. Linear trend in mean values was tested using one-way analysis of variance (ANOVA). Trends in prevalence were tested using Z-test. Using logistic regression analysis, the odds ratios (OR) and 95% confidence intervals (CI) for the occurrence of HSBP, HDBP and HTN were computed relative to the reference category i.e. lower tertile of adiposity indicators viz., BMI. All analysis was done using a statistical program (SPSS/PC Version 17.0 for Windows, SPSS Inc. Chicago IL)

Results

Mean age of the subjects was 32±4.6 yr and majority (76%) were below 35 yr of age, were married (74.2%), had annual income above Rs. 3 lakhs (83.9%), owned the (60.6%) house and 92.9% had education at least up to graduation. Almost half (51.6%) of the subjects were employed in IT companies while spouse of 26.7 % subjects were working women. The subjects thus represented young affluent urban higher middle class population. Their anthropometric measurements given in Table 1 show that mean BMI was 25.2±3.6 Kg/m^2 and mean waist was 86.9±9.1 cm . The overall prevalence of overweight (BMI>=23 Kg/m^2) was as large as 72.5 % while that of obesity (BMI>=25 Kg/m^2) was 48.4%. Mean visceral fat percent was 9.7±4.1 Central obesity based on WC (>=90 cm) was 38.2 % while that based on VF (>12%) was 28.3 % and contributed major part of the overall obesity. Mean systolic blood pressure (SBP) was 121.9 ±10.4 mmHg while mean diastolic blood pressure (DBP) was 79.9±8.6 mmHg with relatively high prevalence of HTN (25.6%) especially due to HDBP (22.4%) rather than due to HSBP (4.3%).

It can be seen (Table 2) that overweight (BMI>=23 Kg/m^2), obese (BMI>=25 Kg/m^2), centrally obese (WC>90cm) and subjects with high VF (>12%) had significantly (p<0.01) high systolic and diastolic blood pressure levels compared to their counterparts

SBP: systolic blood pressure; DBP: Diastolic blood pressure
HSBP: High systolic blood pressure; HDBP: High diastolic blood pressure
HTN : Hypertension; BMI - Body mass index; WC- waist circumference
*p <0.05 ** - p<0.01;

Systolic and diastolic blood pressures were higher by almost 5 mmHg in obese or centrally obese subjects compared to non-obese subjects. Prevalence of HDBP and HTN was almost double among overweight compared to non-overweight and among obese compared to non-obese subjects. The difference was largest for those with high VF compared to their counterpart. However, the difference in the prevalence for subjects with high and low WC didn't reach statistical significance.

Central obesity increased significantly with increase in BMI. Thus, central obesity (WC>=90) increased significantly (p<0.001) from 6% in subjects in normal BMI (<23) category to 68.3% in subjects with high BMI (>25) in these young subjects (Figure.1).

Prevalence of central obesity based on VF also increased similarly (0.0 % to 58.5 %). Prevalence of HTN among normal, overweight and obese subjects was 15.5%, 20.0% and 34.1% respectively and BMI was a main contributor rather than central obesity. For, the cross classification of subjects by categories of BMI and WC or VF shows (Table 3) that prevalence of HTN was high even among subjects with low WC(<90 cm) or low VF(<12%). Therefore, it is necessary to identify factors associated with adiposity. However, the fact that the prevalence is as high as 16.4% among subjects with normal BMI and low WC also demands identification of factors other than adiposity which confer risk for hypertension.

BMI: Body mass index; WC- waist circumference; VF: visceral fat.

We therefore examined the association of several factors associated with obesity (BMI>=25Kg/m^2) and central obesity (WC>=90). It can be seen (Figure 2) that among the socio economic factors, as education increased prevalence of obesity increased significantly (p<0.01).

With increase in income along with obesity even the prevalence of hypertension showed significant increasing (p<0.05) trend. Similarly, obesity was significantly (p<0.05) higher among subjects whose spouse was also working. Subjects owning a four wheeler also showed significantly (p<0.01) higher prevalence of obesity as well as prevalence of HTN (p<0.01). Among the dietary considerations subjects who were non vegetarian had significantly (p<0.05) higher proportion of centrally obese subjects. Factors related to occupation also showed associations with obesity and hypertension. Thus, subjects working in IT companies had significantly higher prevalence of obesity as well as HTN (p<0.01 for both). Feeling stress at work or having unfriendly relation with Boss also showed high prevalence for both obesity and HTN but did not reach statistical significance. However, subjects having job insecurity did show significantly higher prevalence of obesity and HTN (p<0.05 for both). Finally, among the life style factors smoking showed association with obesity (p<0.01), alcohol consumption showed association with obesity (p<0.05) and HTN (p<0.05) both while disturbed sleep was associated with obesity (p<0.05) alone.

Risk for overweight, obesity, central obesity and hypertension was estimated by performing logistic regression (Table 4). The scores for diet, life style and stress were entered as cofactors. It can be seen that non vegetarian diet increases risk by almost two times (OR-

1.94; CI-1.0-3.6) for overweight (BMI>23 Kg/m^2). Beyond it, lifestyle factors increase risk (OR- 2.1; CI: 1.2–3.4) for obesity (BMI>25 Kg/m^2) as well as for central obesity (OR-1.91; CI: 1.1 – 3.2) in a similar way. However, lifestyle factors and stress both increase the risk for high VF (>=12%) almost by three times (OR- 2.78; CI: 1.03–7.5). But, when BMI is high (≥ 25 Kg/m^2) and so is VF, stress has stronger and independent influence as it increases risk for HDBP (OR- 3.64; CI: 1.1 – 12.6) as well as for HTN (OR-4.43; CI: 1.3 – 15.3) making influence of diet and lifestyle factors non-significant.

Discussion

Parallel to obesity, abdominal obesity is also on the rise all across the world, especially increasing at a rapid rate among the developing countries, thus aggravating the existing health burden (1). Research results to date claim that, developing countries have a higher susceptibility of blood pressure (BP) to excessive adiposity than Western populations and will be more severely affected, particularly in terms of hypertension driven cardiovascular morbidity and mortality, by the current global upward trend in obesity. We observed that in young urban males prevalence of obesity, central obesity and consequently hypertension was high. Further, diet, lifestyle factors and stress conferred significant risk for obesity and hypertension and highlighted their importance in prevention of hypertension.

Before discussing the results, it may be worthwhile to discuss some of the following points. It was not possible to have self-monitored blood pressure to avoid white coat effect but is not a serious limitation as it was measured twice and the average of two readings was used in the analysis. Estimation of visceral fat was done using BIA technique and not sophisticated equipment's like DEXA but is unlikely to disturb the associations of VF with hypertension observed in this study. Moreover, the technique has been used to estimate the BF (%) to among Indians by other researchers (16). Life style factors such as smoking or alcohol consumption or stress were not recorded in detail for their frequency or duration, but the associations of these factors with obesity and hypertension were seen indicating that detailed information could be helpful for planning preventive strategies.

Majority of the subjects were overweight and the prevalence of obesity (BMI>=25 Kg/m^2) was high (48.4 %) in these young adults. High prevalence of obesity is also reported among urban males by other Indian researchers (8,17). We further observed that prevalence of central obesity increased significantly from lowest tertile of BMI to highest tertile suggesting tendency for accumulation of abdominal fat. Consequently, overweight and obese subjects had significantly high blood pressure and prevalence of HTN.

High prevalence of HTN (25.6%) is also reported for urban men from the city of Jaipur in India (17). Further, systolic as well as diastolic blood pressure and prevalence of HTN was observed to be significantly higher among obese and centrally obese individuals. In fact, the prevalence was more than double in the highest tertile of BMI (>=26.3 Kg/m^2) compared to that in the lowest tertile indicating the association between adiposity and hypertension. Similar observations are reported among Indians (18) with a BMI value of 26.5 kg/m^2 and in case of US Caucasian populations (19) but with much higher value of BMI of 30 kg/m^2. This observation highlights the fact that although the increasing trends are comparable with the western populations, it is worthwhile to note that the risk of hypertension is much higher at lower level of BMI among Indians.

Among overweight subjects, prevalence of HTN was zero even when WC was high indicates that perhaps cut off of 90 is on higher side for Indian subjects and needs to be customised. On the other hand, it was as high as 16% even among those with normal BMI (<23 Kg/m^2) necessitated it to investigate influence of factors other than adiposity. Univariate analysis showed variables indicating better socioeconomic conditions (higher education, higher income, having a four wheeler, whose spouse was working) were associated with obesity and/ HTN and is in confirmation with the observation reported by other Indian researchers (20,21,8). Similarly, the observations that smoking was associated with obesity ($p<0.01$), while alcohol consumption was associated with obesity ($p<0.05$) and HTN ($p<0.05$) are in confirmation with those reported (22) among urban population of Kolkata and among Rotarians from Pune (23). However, very few Asian studies have considered the effect of confounders while assessing the relationship between obesity and NCDs (24). These observations indicate that detail investigations on frequency and duration of smoking and alcohol consumption may be needed for prevention of hypertension.

India Health Study that investigated the risk of diet in pathogenesis of obesity and NCDs among Indian adults aged 35-69 years showed that across regions,

about 80% of subjects were abdominally obese and that dietary patterns characterized by increased consumption of animal products, fried snacks and sweets were positively associated with it (25). Our observation that consumption of non-vegetarian diet confers almost two times risk for central obesity is in confirmation with this large cross-sectional study.

Multiple logistic regression considering all the cofactors showed that non vegetarian diet was a risk factor (OR- 1.94; CI-1.1-3.6) for overweight while lifestyle factors increased risk for obesity (OR- 2.1; CI:1.2–3.4) as well as central obesity (OR- 1.91; CI:1.1 – 3.2). But, among subjects with high BMI, stress showed independent influence on HTN (OR- 4.43; CI: 1.3 – 15.3) making influence of diet and lifestyle factors non-significant. In other words effect of diet and life style factors are mediated through adiposity.

Conclusion

In conclusion, observations highlight the importance of several risk factors for obesity and hypertension which are modifiable. Primary prevention community programs for promoting healthy dietary habits, reducing alcohol consumption, increasing physical activity and improving work environment are essential for reducing obesity and consequent risk of NCDs among young urban males from big cities like Pune

Authors Contribution

All authors have contributed equally in this article.

References

1. Balkau B, Deanfield JE, Despres JP, Bassand JP, et.al. International Day for the Evaluation of Abdominal Obesity (IDEA): A Study of Waist Circumference, Cardiovascular Disease and Diabetes Mellitus in 168000 primary care patients in 63 countries. Circulation2007; 116:1942–1951.
2. Shetty PS. Nutrition transition in India. Public Health Nutr. 2002 Feb;5(1A):175-82. Review. PubMed PMID: 12027282.[PubMed]
3. Griffiths PL, Bentley ME. The nutrition transition is underway in India. J Nutr. 2001 Oct;131(10):2692-700. PubMed PMID: 11584092.[PubMed].
4. Gupta R, Sarna M, Thanvi J et al. High prevalence of multiple coronary risk factors in Punjabi Bhatia Community: Jaipur Heart Watch - 3. Ind Heart J 2004;56:646-652.
5. Misra A, Vikram NK, Gupta R, Pandey RM, Wasir JS, Gupta VP. Waist circumference cutoff points and action levels for Asian Indians for identification of abdominal obesity. Int J Obes (Lond). 2006 Jan;30(1):106-11. PubMed PMID: 16189502.[PubMed].
6. Gupta M, Patil R, Khan MI and Gupta SK. The Prevalence of Obesity and Hypertension in Urban Tamilnadu. J Clin Diag Res2011; 5:586-588.
7. Iyer U, Elayath N, and Desai P. Comparative prevalence of non-communicable diseases in the adult population of Vadodara and Godhra in Gujarat and determinants of diabetes mellitus in the population. Int J App Bio Pharma Tech 2011; 2:346-352.
8. Mohan V, Shanthirani S, Deepa R et al. Intra-urban differences in the prevalence of the metabolic syndrome in southern India - the Chennai Urban Population Study (CUPS No. 4). Diab Med 2001;18:280-287.
9. Kissebah AH, Vydelingum N, Murray R, Evans DJ, Hartz AJ, Kalkhoff RK, Adams PW. Relation of body fat distribution to metabolic complications of obesity. J Clin Endocrinol Metab. 1982 Feb;54(2):254-60. PubMed PMID: 7033275.[PubMed].
10. Kissebah AH, Peiris AN. Biology of regional body fat distribution: relationship to non-insulin-dependent diabetes mellitus. Diabetes Metab Rev. 1989 Mar;5(2):83-109. Review. PubMed PMID: 2647436.[PubMed].
11. Ramachandran A, Snehalatha C, Kapur A et al. High prevalence of diabetes and impaired glucose tolerance in India: National Urban Diabetes Survey. Diabetologia 2001; 44:1094-1101.
12. Reddy KS, Prabhakaran D, Shah P, Shah B. Differences in body mass index and waist: hip ratios in North Indian rural and urban populations. Obes Rev. 2002 Aug;3(3):197-202. PubMed PMID: 12164472.[PubMed]
13. World Health Organization. The Asia-Pacific Perspective: Redefining Obesity and its Treatment. World Health Organization (WHO) / International Association for the Study of Obesity (IASO)/International Obesity Task Force (IOTF). Health Communication Australia PTY Ltd., 2000;1-25.
14. World Health Organization. Global status report on noncommunicable diseases 2010. WHO, Geneva 2011; vii.
15. Chobanian AV, Bakris GL, Black HR, et al. The seventh report of the Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure. JAMA 2003; 289:2560-2572.
16. Singh RB, Niaz MA, Beegom R et al. Body Fat Percent by Bioelectrical Impedance Analysis and Risk of Coronary Artery Disease Among Urban Men with Low Rates of Obesity: The Indian Paradox. J Am Coll Nutr 1999;18:268–273.
17. Gupta R, Gupta VP, Sarna M et al. Prevalence of coronary heart disease and risk factors in an urban Indian population: Jaipur Heart Watch - 2. Ind Heart J 2002;54:59-66.
18. Kaur P, Radhakrishnan E, Rao SR, Sankarasubbaiyan S, Rao TV, Gupte MD. The metabolic syndrome and associated risk factors in an urban industrial male population in South India. J Assoc Physicians India. 2010 Jun;58:363-6, 371. PubMed PMID: 21125777.[PubMed].
19. Menke A, Muntner P, Wildman RP, Reynolds K, He J. Measures of adiposity and cardiovascular disease risk factors. Obesity (Silver Spring). 2007 Mar;15(3):785-95. PubMed PMID: 17372330.[PubMed].
20. Visweswara Rao K, Balakrishna N and Shatrugna V. Variation in forms of malnutrition in well-to-do adults and the associated factors. Man in India 1995;75:241-249.
21. Gopalan, C. Obesity in the Indian Urban 'Middle Class'. NFI Bull 1998;19:1-4.
22. Guha S, Ghosh A, Chatterjee N, Pal S, Guha S, Chatterjee S, Deb PK, Dawn B. Risk factors for coronary heart disease in Indians: a case-control study from Eastern India. Indian Heart J. 2005 Nov-Dec;57(6):738-40. PubMed PMID: 16521652.[PubMed].

23. Parab Prajakta. Assessment of abdominal obesity for screening NCD risks among
24. urban affluent adults from India. Ph.D. Thesis, University of Pune, 2011;India.
25. Lee W-Y, Jung C-H, Park J-S et al. Effects of smoking, alcohol, exercise, education and family history on the metabolic syndrome as defined by the ATP III. Diabetes Research and Clinical Practice2005;67:70-77.
26. Daniel CR, Prabhakaran D, Kapur K et al. A cross sectional investigation of regional patterns of diet and cardio-metabolic risk in India. Nutrition Journal 2011;10:12

Tables

TABLE 1 MEAN (± SD) VALUES OF MEASURES BY AGE GROUP

Age (yr)	N	Body wt (Kg) Mean	sd	Height (cm) Mean	sd	BMI (Kg/m^2) Mean	sd	WC (cm) Mean	sd	VF (%) Mean	sd
25-30	101	72.6	12.1	169.6	6.5	25.2	3.4	86.1	9.9	9.2	3.8
30-35	92	73.2	13.5	169.1	7.2	25.5	4.0	88.0	9.0	10.3	4.6
≥35	61	69.2	10.8	167.5	6.7	24.6	3.0	86.5	7.9	9.6	3.5
Total	254	72.0	12.4	169.0	6.8	25.2	3.6	86.9	9.1	9.7	4.1

TABLE 2 MEAN (± SD) BLOOD PRESSURE AND PREVALENCE (%) OF HTN BY INDICATORS OF ADIPOSITY

Indicator	Cut off	N	%	SBP (mmHg) Mean	sd	DBP (mmHg) Mean	sd	HTN prev.	HSBP prev.	HDBP Prev.
Overweight (BMI Kg/m^2)	< 23	70	27.5	118.1	11.5	76.3	9.2	15.7	4.2	12.9
	≥ 23	184	72.5	123.4	9.6**	81.3	7.9**	29.3*	4.3	26.1*
Obesity (BMI Kg/m^2)	< 25	131	51.6	119.5	10.6	77.5	8.9	17.6	3.1	14.5
	≥ 25	123	48.4	124.4	9.6**	82.4	7.5**	34.1*	5.7	30.9*
Central obesity (WC) cm	<90	157	61.8	120.4	11.1	78.7	9.1	22.9	4.5	19.7
	≥ 90	97	38.2	124.4	8.6**	81.9	7.3**	29.9	4.1	26.8
Visceral fat (VF %)	<12	182	71.7	120.1	10.3	78.4	8.5	18.7	2.2	16.5
	≥12	72	28.3	126.5	9.2**	83.5	7.7**	43.1**	9.7*	37.5**

TABLE 3 PREVALENCE OF HYPERTENSION IN CROSS CLASSIFIED CATEGORIES OF BMI AND CENTRAL OBESITY

Central obesity	n	Normal BMI(Kg/m^2) <23	Overweight 23 ≤BMI (Kg/m^2) < 25	Obese BMI (Kg/m^2) ≥ 25
WC <90 cm	157	16.4	23.5	33.3
WC≥ 90 cm	97	0.0	0.0	34.5
VF <12 % VF≥12 %	182	15.5	20.0	21.6
	72	0.0	0.0	43.1

TABLE 4 ODDS RATIO (OR) FOR OVERWEIGHT, OBESITY, CENTRAL OBESITY AND HYPERTENSION

Risk for	OR (95% CI) Stress	Life style	diet	BMI tertile L	M	H
Overweight (BMI ≥ 23 Kg/m^2)			1.94 (1.04 - 3.6)	---- --		
Obesity (BMI ≥ 25 Kg/m^2)		2.1 (1.2 – 3.4)		-------		
Central obesity (WC ≥ 90cm)		1.91 (1.1 – 3.2)		--------		
Central obesity (VF ≥ 12%)	2.78 (1.03 – 7.5)	1.88 (1.05 – 3.3)				
Hypertension	4.43 (1.3 – 15.3)	--	--	1.0	1.2 (0.5 - 2.6)	2.88 (1.4 - 6.0)
High diastolic blood pressure	3.64 (1.1 – 12.6)	--	--	1.0	1.4 (0.6 - 3.2)	3.03 (1.4 - 6.6)

BMI: Body mass index; WC- waist circumference; VF: visceral fat

Figures

FIGURE 1 PREVALENCE OF CENTRAL OBESITY AND HYPERTENSION BY CATEGORIES OF BMI

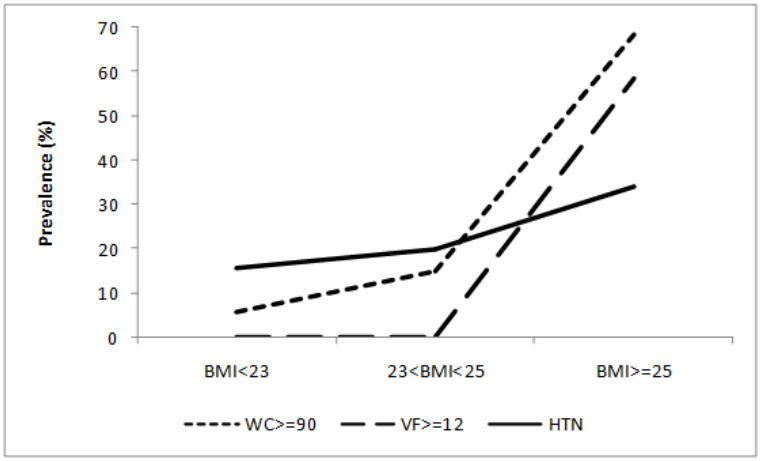

FIGURE 2 RISK FACTORS FOR OVERALL AND CENTRAL OBESITY AND HYPERTENSION