ORIGINAL ARTICLE

Prevalence of obesity and correlation among various obesity indices among security personnel in a tertiary care hospital in Delhi

Arihant Jain[1], Anita Shankar Acharya[2], Sanjeev Kumar Rasania[3], Ananya Ray Laskar[4]

[1]Department of Community Medicine, Government Medical College Sheopur, Madhya Pradesh

[2,3,4]Department of Community Medicine, Lady Hardinge Medical College, New Delhi

CORRESPONDING AUTHOR

Dr Arihant Jain, House number 1858, Vajeer Singh Street, Chuna Mandi, Pahadganj, New Delhi, 110055

Email: Arihantjain36450@gmail.com

CITATION

Jain A, Acharya AS, Rasania SK, Laskar AR. Prevalence of obesity and correlation among various obesity indices among security personnel in a tertiary care hospital in Delhi. Indian J Comm Health. 2025;37(3):388-393.

https://doi.org/10.47203/IJCH.2025.v37i03.006

ARTICLE CYCLE

Received: 16/04/2025; Accepted: 25/05/2025; Published: 30/06/2025

ABSTRACT

Background: Obesity represents a growing public health concern worldwide, and certain occupational groups, such as security personnel, face a heightened risk. **Aims**: The purpose of this cross-sectional study was to assess how common obesity is among the subjects and to analyse the relationship between different measures of obesity among 356 security personnel in a tertiary care hospital in Delhi. **Methodology**. The study assessed indices such as Body Mass Index (BMI), Waist-Hip Ratio (WHR), Waist Circumference (WC), Conicity Index (CI), and Waist Stature Ratio (WSR), using both WHO and Asia-Pacific guidelines. **Results**: The study revealed that 41.6% of the security personnel were overweight, while 7.3% were obese according to WHO criteria. In contrast, based on Asia-Pacific criteria, 49.2% were obese. Females exhibited a higher prevalence of obesity than males, with significant gender disparities in WC, WHR, and CI. WHR showed a total prevalence of 77.2%, while WSR indicated that 64.9% were obese. CI demonstrated a positive correlation with WC and WHR, while WSR was strongly correlated with all indices. **Conclusion**: The study highlights the importance of using multiple obesity indices to assess obesity among security personnel comprehensively. These findings emphasise the need for targeted interventions to address obesity in this occupational group, which could reduce the risk of obesity-related health conditions.

KEYWORDS

Obesity, Body Mass Index, Waist Circumference, Waist-Hip Ratio, Anthropometry (for Conicity Index)

INTRODUCTION

Majority of people resides in nations where being overweight is more common than being underweight. In 2016, over 1.9 billion adults were classified as overweight or obese around the world; among them, 39% were overweight, and one-third were obese. (1) In India, there is a trend showing nearly one in every four persons being overweight or obese in the year 2019-20, as compared to one in every five earlier in 2015-16. Also, DALYs have become 22,071/ lakh. (2) Obesity acts as a risk factor for many diseases; hence, the American Medical Association classified it as a disease, acknowledging its complex nature beyond mere lifestyle choices. (3) Diagnosing obesity most commonly involves BMI, a surrogate marker of fatness, which is classified according to the WHO and Asia-Pacific criteria. (4) Since BMI is not a reliable indicator for predicting body composition and fat distribution, other indicators are needed, such as Waist Circumference (WC), Conicity Index (CI), and Waist-to-Stature ratio (WSR). WC is a straightforward indicator of fat concentrated in the abdominal area. (5) The CI is derived from WC, weight, and height. (6) Similarly, the WSR provides an accessible means to evaluate abdominal fat relative to stature. These indices are practical, validated, and predictive for clinical and epidemiological use. (7) Very few studies have been conducted to assess obesity in security personnel.

AIM

To determine the prevalence of Obesity among security personnel in a tertiary care hospital in Delhi.

OBJECTIVES

- To find the prevalence of obesity based on several anthropometric indicators, including BMI, WHR, WC, CI, and WSR, among security personnel in a tertiary care hospital in Delhi
- To compare the prevalence of obesity based on the WHO and Asian Pacific guidelines of BMI among study subjects
- To find the correlation between various obesity indices among study subjects.

MATERIAL & METHODS

Study Type & Study Design: A hospital-based observational, analytical, and cross-sectional study was conducted among 356 security personnel aged between 19 and 63 years in a tertiary care hospital in Delhi.

Study Setting: The TRIG Group is a security service provider that recruited security personnel working in the study setting from 1st August 2022, which constituted the study population. The security guards were posted in various college, hospital, and hostel campus locations.

Study Population: 356 security personnel aged between 19 and 63 years working in the tertiary care hospital campus.

Study Duration: The study was conducted from November 2022 to February 2024.

Sample Size Calculation: The sample size for the study was determined using the formula:

$$N = (Z_{1-\alpha/2})^2 \times p \times (1-p) / d^2$$

In this equation, N is the sample size, $Z_{1-\alpha/2}$ is the critical value at the desired confidence level, p is the estimated prevalence, and d is the relative error. For a 95% confidence interval, the value of $Z_{1-\alpha/2}$ is 1.96. Prevalence was taken as 23.8%, based on findings from a previous study.(8) With a relative error (d) set at 20% of the prevalence, the initial calculated sample size was 308. An additional 15% was added for potential non-response, resulting in a final sample size of 354. Given that there were a total of 356 security personnel available on the hospital campus at the commencement of the study, the entire population of security personnel in the study was included.

Inclusion Criteria: All the security personnel who had been working as security personnel for at least 6 months and were willing to participate in the study were included.

Exclusion Criteria: Pregnant security personnel were excluded.

Strategy for Data Collection: Written consent was taken, and confidentiality was maintained. A digital weighing scale, which was self-calibrating and placed on an even surface, was used for weight measurement. A portable stadiometer marked in centimetres and inches was used for height measurement. A non-stretchable measuring tape measured waist and hip circumferences. Waist circumference was measured by placing the tape midway between the lower border of the rib cage and the top of the iliac crest, ensuring it fits snugly without pinching the skin, with subjects breathing out normally and hands at their sides. Hip circumference was measured at the widest point of the hips, with female subjects assisted by a female staff member. The Conicity Index (CI) and Waist Stature Ratio were calculated based on these measurements.

Working Definition (Diagnostic Criteria)

The research utilized several key obesity indicators, namely BMI, Waist-Hip Ratio, Waist Circumference, Conicity Index, and Waist Stature Ratio, with the following criteria for diagnosing obesity:

- BMI was determined using Asian Pacific region and WHO guidelines.
- WHR cut-offs were >0.90 for males and >0.85 for females.
- Waist Circumference indicated increased risk at >94 cm for men and >80 cm for women.
- The Conicity Index was set at 1.25 for males and 1.18 for females.
- Waist Stature Ratio >0.5 was used.

All anthropometric measurements were conducted in a private room with minimal clothing to ensure accuracy.

The CI, a model-based index of abdominal obesity ranging from 1.0 to 1.73, was computed using the formula:

CI = WC (m)/ (0.109 ×√ [body weight (kg)/height (m)])

The Waist Stature Ratio was calculated as: Waist Circumference (cm)/Height (cm)

Ethical Issues & Informed Consent

Ethical clearance was obtained from the Institutional Ethics Committee {LHMC/IEC/2022/PG Thesis/28}. Informed written consent was obtained.

RESULTS

The study assessed the prevalence of obesity using multiple metrics, including Body Mass Index, the ratio of waist to hip circumference, waist measurement, the Conicity Index, and the waist-to-stature ratio among security personnel in a tertiary care hospital in Delhi and compared the prevalence

of obesity based on WHO and Asian Pacific guidelines of BMI among study subjects, and also found the correlation between various obesity indices among security personnel in a medical college. A total of 356 study subjects were enrolled in the study.

Table 1: Socio-demographic characteristics of study subjects (N=356)

Sociodemographic characteristics	Males n (%)	Females n (%)	Total N (%)
	304(85.4)	52 (14.6)	356 (100)
Age group (in years)			
< 30	162 (53.3)	18 (34.6)	180 (50.6)
30 -39	79 (26.0)	26 (50.0)	105 (29.5)
40 -49	40 (13.2)	08 (15.4)	48 (13.4)
50-59	16 (5.3)	0 (0.0)	16 (4.5)
60 and more	07 (2.2)	0 (0.0)	07 (2.0)
Marital status			
Married	223 (73.4)	46 (88.5)	269 (75.6)
Unmarried	81 (26.6)	03 (5.8)	84 (23.5)
Widowed and Divorcee	0 (0.0)	03 (5.7)	03 (0.9)
Religion			
Hindu	282 (92.8)	51 (98.1)	333 (93.5)
Muslim	19 (6.2)	01 (1.9)	20 (5.6)
Sikh	03 (1.0)	0 (0.0)	03 (0.9)
Education			
Postgraduate	6 (2.0)	0 (0.0)	06 (1.7)
Graduate	111 (36.5)	9 (17.3)	120 (33.7)
Intermediate	116 (38.2)	17 (32.7)	133 (37.3)
High school	71 (23.3)	26 (50.0)	96 (27.3)
Socioeconomic status			
Upper class	73(24.0)	20(38.5)	93(26.1)
Upper Middle class	165(54.3)	27(51.9)	192(53.9)
Middle class	62(20.4)	05(9.6)	67(18.9)
Lower middle class	04(1.3)	0	04(1.1)

As per the revised B.G. Prasad's socioeconomic status classification for the year 2023

Table 2: BMI among Study subjects based on gender according to WHO classification (N=356)

BMI Classification	Males n (%)	Females n (%)	Total N (%)
Underweight (<18.5)	11(3.6)	01 (1.9)	12 (3.4)
Normal BMI (18.5 to 24.9)	145 (47.7)	25(48.1)	170 (47.8)
Overweight (25 to 29.9)	128 (42.1)	20 (38.5)	148 (41.6)
Obesity (>=30)	20 (6.6)	6 (11.5)	26 (7.3)
Obesity class 1(30 to 34.9)	18 (5.9)	04 (7.7)	22(6.2)
Obesity class 2(35 to 39.9)	02 (0.7)	02 (3.8)	04 (1.1)
Total	304 (100.0)	52 (100.0)	356 (100.0)

Table 3: BMI among Study subjects based on gender according to the Asian Pacific classification (N=356)

BMI Classification	Males n (%)	Females n (%)	Total N (%)
Underweight (<18.5)	11 (3.6)	1 (1.9)	12 (3.4)
Normal BMI (18.5 to 22.9)	83 (27.3)	12 (23.1)	95 (26.7)
Overweight (23 to 24.9)	62 (20.4)	12 (23.1)	74 (20.8)
Obesity (>=25)	148 (48.7)	27 (51.9)	175 (49.2)
Obesity class 1(25-29.9)	128(42.1)	21(40.3)	149(41.9)
Obesity class 2(>=30)	20(6.6)	06(11.6)	26(7.3)
Total	304 (100.0)	52 (100.0)	356 (100.0)

Table 4: Median value and interquartile range of various Obesity indices among study subjects. (N=356)

Obesity index		Median value	Interquartile range (Q_1-Q_3)
BMI (kg/m^2)	Overall	24.84	22.3-27.12
	Male	24.65	22.31-26.99

	Female	25.20	22.96-28.70
WSR	Overall	0.52	0.49-0.55
	Male	0.51	0.49-0.54
	Female	0.57	0.54-0.61
CI	Overall	1.24	1.21-1.29
	Male	1.24	1.20-1.27
	Female	1.30	1.25-1.34
WHR	Overall	0.93	0.90-0.96
	Male	0.94	0.91-0.97
	Female	0.90	0.87-0.95
WC	Overall	88	83-92
	Male	88	82-91.75
	Female	89	85.25-96.25

Table 5: Prevalence of Obesity among study subjects based on various obesity indices. (N=356)

	Males n (%)	Females n (%)	Total N (%)
Waist Hip Ratio	231(76.0)	44(84.6)	275(77.2)
Waist Circumference	40(13.2)	48(92.3)	88(24.7)
Waist Stature ratio	185(60.9)	46(88.5)	231(64.9)
Conicity Index	137(45.1)	46(88.5)	183(51.4)

Table 6: Correlation* of various obesity indices in the security personnel (N=356)

		CI	WSR	BMI	WC	WHR
Conicity Index	Correlation Coefficient		.554	-.014	.530	.488
	P-value		.000	.787	.000	.000
Waist Statue Ratio	Correlation Coefficient	.554		.738	.882	.426
	P-value	.000		.000	.000	.000
Body Mass Index	Correlation Coefficient	-.014	.738		.767	.259
	P-value	.787	.000		.000	.000
Waist Circumference	Correlation Coefficient	.530	.882	.767		.522
	P-value	.000	.000	.000		.000
Waist Hip Ratio	Correlation Coefficient	.488	.426	.259	.522	
	P-value	.000	.000	.000	.000	

Correlation is significant at the 0.01 level (2-tailed).

**By Spearman's Rho correlation coefficient*

DISCUSSION

Obesity is a significant health concern in India, affecting various occupational groups. This study looked at security personnel, a group with limited prior research, using a detailed design that measured various obesity indicators.

The study was conducted on 356 security personnel, including 304 males (85.4%) and 52 (14.6%) females. The median age of the study subjects was 30 years (IQR: 26-37 years), with males having a median age of 30 years (IQR: 26 to 38 years) and females 33 years (IQR: 29-35 years). Notably, more than half of the study subjects (50.6%) were under 30 years old. Only 7(2.2%) study subjects were above 60 years.

Diagnostic criteria for diagnosing obesity according to BMI cut-off were according to both the Asian Pacific region guidelines and the WHO BMI guidelines. In the current study, the median BMI of study subjects was 24.8 kg/m^2 with an IQR of 22.3 to 27.1 kg/m^2. As per the WHO classification of BMI, the overall prevalence of obesity was 7.3%. Similar results were shown by Mathur P et al (6.2%) in the general population, Prabhu NJ et al (6%), Kumar A et al (8.9%), and Shaidah JB et al (11%) in security personnel. (9,10,11,12) Patnaik A et al (31.5%) and Tan SX et al (30.4%) did not have similar findings. (8,13) Wahab MA et al showed a prevalence of only 1.2%, which may be attributed to physical fitness since the study subjects were border security guards. (14) In the current study, as per the WHO classification of BMI, the overall proportion of pre-obese in the current study was 41.6%, similar to other studies. Shaidah JB et al (32%), and Mathur P Et al (26.1%) showed a lower prevalence, whereas Arredondo GP et al (65.3%), Wahab MA et al (52.5%), and Kumar A et al (76.9%) showed a higher prevalence. (9, 11, 12, 14, 15)

In the current study, the prevalence of overweight was 20.8% and obesity was 49.2% using the Asian Pacific criteria for BMI. This is comparable to the study by Widyahening IS et al (16). In another study by Bhandare P et al, a slightly higher prevalence was found, i.e. 39% of the study subjects had a BMI in the overweight range, and 58% were obese. (17) In this study, study subjects with a waist-hip ratio above the normal range was 84.3%. This is higher than the findings by Patnaik A et al, who found that 52.2% of the Subjects had a high waist-hip ratio. (8) In police personnel, as per Puri MA et al, however, the waist-hip ratio was normal only in 7.9% of subjects (n=27). (18)

The waist-hip ratio indicates a higher prevalence of obesity in females (84.6%) than in males (76%), with an overall prevalence of 77.2%. This is higher than the findings by Patnaik A et al, who found 52.2% of study participants had a high waist-hip ratio. (13) There is a significant difference in higher-than-normal waist circumference between genders, with only 13.2% in males compared to 92.3% in females, totalling 24.7%. This is not in line with the results of NFHS-5 data, in which, compared to females (39.6%), the prevalence of waist circumference was lower in men (11.9%). (13) The Waist Stature ratio reveals obesity in 60.9% of males and 88.5% of females, amounting to 64.9% overall. Although the waist-to-stature ratio is mostly used in children, very few studies have been done on adults. It is comparable to Shikha D et al, in which a high Weight Stature ratio was recorded at 66.8%. (20)

Studies on the conicity index in India are limited. The current study shows that obesity according to the Conicity Index is higher in 88.5% of females than males (45.1%), with an overall prevalence of 51.4%. This is comparable to a study by Flora MS et al conducted in Bangladesh, in which males had a prevalence of 21.7%, females had 56.7 %, and overall prevalence was 40.8%. (21) Hence it is evident that the overall prevalence of the conicity index is usually higher in females. CI showed a strong positive correlation with WC (r =0.530) and WHR (r =0.488), but a non-significant correlation with BMI (r = -0.014). WSR was strongly correlated with all other indices, particularly WC (r =0.882) and BMI (r=0.738). BMI has a strong positive correlation with WC (r =0.767) and a moderate correlation with WHR (r =0.259). Haregu TN et al found a correlation between BMI and WC (r = 0.69). The BMI and WHR correlations are comparable to, Haregu TN et al (r = 0.12) and Diaz ME et al (r =0.2537). (22,23) Haregu TN et al found a correlation between BMI and WSR (Waist-to-Height Ratio) of 0.75. WC correlated strongly with WSR (r =0.882) and BMI (r =0.767), and moderately with WHR (r =0.522). (22) Haregu TN et al found a correlation between WHR and WC is 0.44. (22) WHR showed moderate to strong correlations with other indices, notably (r = 0.522) with WC. Haregu TN et al found a correlation between WC and WSR of 0.93 and a correlation between WHR and WSR of 0.38.(22)

While the study found a strong correlation between these obesity measures, it had some limitations; it could not show cause and effect and was not representative of all security personnel. The results highlight a high obesity prevalence, suggesting the need for targeted health programs and policy changes. However, differences in obesity rates across measures and between genders raise questions, leading to calls for more research to better understand these issues and confirm the findings in other groups.

CONCLUSION

The study reveals a high and concerning prevalence of obesity among security personnel, which becomes particularly evident when using the Asia-Pacific BMI criteria and other indices of abdominal obesity. A significant disparity exists between genders, with female personnel exhibiting substantially higher rates of obesity across almost all metrics. The strong correlation between various anthropometric indices confirms their utility, while also highlighting that waist-based measurements (WC and WSR) identify abdominal obesity risk that BMI alone may underestimate. These findings underscore the critical need for targeted health interventions and regular monitoring within this occupational group to mitigate the associated health risks.

RECOMMENDATION

(Public health importance)

Implement regular health screening, develop targeted weight management programs, and encourage physical activity and lifestyle modifications

LIMITATIONS OF THE STUDY

Single-Centre Study, Cross-Sectional Design, specific population involved so no generalisability

RELEVANCE OF THE STUDY

It provides a comprehensive assessment of obesity using multiple metrics among a specific occupational group (security personnel) that is rarely studied.

AUTHORS CONTRIBUTION

All authors have contributed equally.

Financial Support and Sponsorship

Nil

Conflict of Interest

There are no conflicts of interest.

Acknowledgement

I would like to thank my life mentor Acharya Prashant, faculty Dr Anita Shankar Acharya, Dr SK Rasania, Dr Ananya Ray Laskar and my senior Dr Abhishek Garg, my junior Dr Kaniska Garg for inspiring me for this work.

Declaration of Generative AI and AI Assisted Technologies in the Writing Process

The authors haven't used any generative AI/AI assisted technologies in the writing process.

References

1. World Health Organisation. Obesity and overweight [Internet]; 2021. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight [last accessed on 28/12/24].
2. Status of Non-Communicable Diseases (NCDs) in India [Internet]; 2022. Available from: https://www.pib.gov.in/www.pib.gov.in/Pressreleaseshare.aspx?PRID=1 796435 [last accessed on 2024, Feb 28]
3. American Medical Association. Report of the Council on Science and Public Health. Is Obesity a Disease? 2013. Available from: https://www.ama-assn.org/sites/ama-assn.org/files/corp/media-browser/public/about-ama/councils/Council%20Reports/council-on-science-public-health/a13csaph3.pdf
4. Misra A, Chowbey P, Vikram NK, Wasir JS, Chadha D, Joshi SR, et al. Consensus Statement for Diagnosis of Obesity, Abdominal Obesity and the Metabolic Syndrome for Asian Indians and Recommendations for Physical Activity, Medical and Surgical Management. 2009;57:163-170.
5. Ross R, Berentzen T, Bradshaw AJ, Janssen I, Kahn HS, Katzmarzyk PT, et al. Does the relationship between waist circumference, morbidity and mortality depend on measurement protocol for waist circumference? Obes Rev. 2008;9(4):312-25.
6. Ghosh J, Chaudhuri D, Saha I, Chaudhuri AN. Association of conicity index with different cardiovascular disease risk factors among rural elderly women of West Bengal, India. Indian J Community Med. 2022;47:18-22.
7. Guo X, Gong S, Chen Y, Hou X, Sun T, Wen J, et al. Lifestyle behaviours and stress are risk factors for overweight and obesity in healthcare workers: a cross-sectional survey. BMC Public Health. 2023;23:1791.
8. Patnaik A, Dash A, Samal M, Nanda S. Health profile of security personnel in a tertiary care hospital in Odisha. Natl J Physiol Pharm Pharmacol. 2022;12(9):1408-1413.
9. Prabhu P, Kulothungan V, Leburu S, Krishnan A, Chaturvedi HK, Salve HR, et al. National noncommunicable disease monitoring survey (NNMS) in India: Estimating risk factor prevalence in adult population. PLOS ONE. 2021;16(3):1-17.
10. Prabhu NJ, Kishore J, Kumar A. Prevalence of Substance Abuse, Hypertension and Obesity among Security Men working in a Teaching Hospital in Delhi: A Cross-Sectional Survey.2014;2: 70-75.
11. Kumar A, Gautam PB, Pore P. Prevalence of hypertension and its associated risk factors among police personnel of a metropolitan city. Asian J Med Sci. 2023; 14(3):122–129.
12. Shaidah JB. Risk factors of hypertension among security officers of the University of Ghana, Legon campus. University of Ghana, 2016;1-53.
13. Tan SX, Ibrahim N, Johari N, Rusli R, Abdul Manaf Z. Obesity is associated with more sick leave and lower quality of life among Malay male security officers. Malaysian J Med Health Sci. 2016;14(02):31–37.
14. Wahab MA, Rahman MM, Razzak MA, Rahman MH, Parvin M, Zafreen F. Prevalence of Metabolic Syndrome among Border Guard Bangladesh Personnel. J Armed Forces Med Coll. 2020;14(2):97–100.
15. Arredondo GP. Body mass index in a group of security forces (policemen). Cross-sectional study. New Insights Obes Gene Beyond. 2018;2(1):1–4.
16. Widyahening IS, Vidiawati D, Pakasi TA, Soewondo P, Ahsan A. Noncommunicable diseases risk factors and the risk of COVID-19 among university employees in Indonesia. PLoS ONE. 2022;17(6):1-12.
17. Bhandare A, Kulkarni A, Sanklecha S, Chitapure T. Prevalence of Low Back Pain in Security Guards in MGM Institute of Health Sciences, Aurangabad. 2020; Int J Health Sci Res. 2020; 10(9):336-345.
18. Puri MA, Joshi MP. Hypertension among Police Personnel with Reference to Perceived Stress - A Cross Sectional Study. Occup Med Health Aff. 2019;7(2):1-4.
19. National Family Health Survey (NFHS-5) [Internet]. Available from: https://rchiips.org/nfhs/factsheet_NFHS-5.shtml [last accessed on 25/12/24]
20. Shikha D, Semwal J, Srivastava AK, Vyas S, Juyal R. An epidemiological evaluation of predictors of overweight and obesity in Garhwal region of Uttarakhand. J Prev Med Hyg 2019;60:E211-E218.
21. Flora MS, Mascie-Taylor CGN, Rahman M. Conicity index of adult Bangladeshi population and their socio-demographic characteristics. J Health Popul Nutr. 2009;27(5):545-554.
22. Haregu TN, Oti S, Egondi T, Kyobutungi C. Measurement of overweight and obesity in an urban slum setting in sub-Saharan Africa: a comparison of four anthropometric indices. BMC Obes. 2016;3:46.
23. Diaz ME, Mainous AG, Everett CJ, Player MS. The association between waist-to-hip ratio, body mass index, and cardiovascular risk factors among adults. J Am Board Fam Med. 2007;20(4):409-16.
24. World Health Organization. Waist Circumference and Waist-Hip Ratio: Report of a WHO Expert Consultation, Geneva, 8-11 December 2008. Geneva: World Health Organization; 2011.
25. Ashwell M, Hsieh SD. Six reasons why the waist-to-height ratio is a rapid and effective global indicator for health risks of obesity and how its use could simplify the international public health message on obesity. Int J Food Sci Nutr. 2005;56(5):303-7.