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Article

Association of Overweight and Central Obesity in Women of Reproductive Age and Overweight Children below Five Years of Age

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Abstract: Introduction: Childhood obesity is becoming an emerging public health issue as it is associated with increased morbidity and premature deaths. Determinants like the child's household characteristics, maternal weight before the preconception stage, and maternal weight in childhood are studied. There is no study available to understand the association between overweight women of reproductive age and overweight children under five years of age. Studying these determinants to understand the problem can help in framing policies to intervene in the issue. **Methods:** The data for the study was collected from the National Family Health Survey 5 (NFHS5). It has been sub-grouped into urban and rural categories. The percentage of women with high-risk Waist-Hip-Ratio (WHR) and the percentage of overweight women were independent variables whereas the percentage of overweight under-five children was dependent. Simple linear regression, multiple linear regression, and Pearson correlation coefficient analysis were done for the collected data. **Results:** Study shows the percentage of overweight women has increased by 4.1%, and the percentage of overweight children has increased by 2% during the NFHS5 (2019-21) compared to NFHS4 (2015-16). Pearson correlation coefficient (R) is 0.5662 and β -coefficient for multiple linear regression is 0.1397 for central obesity in women (%) and percentage of overweight children. **Conclusion:** Central obesity in women is more common than the overweight. Overweight in women as well as in children under five is increasing. Central obesity in women shows a moderate positive relation with overweight in children under five years.

Keywords: child health; overweight; WHO; obesity; NFHS5; waist-hip ratio

1. Introduction

As per the World Health Organization (WHO), 37 million children under five were overweight in 2022. Overweight is the condition of excessive fat deposits. It is weight for height greater than 2 standard deviations above WHO child growth standards median [1]. Childhood obesity affects physical and psychological health with consequences like non-insulin-dependent diabetes, hypertension, gastroesophageal reflux (GER), cardiovascular problems, hepatic steatosis, bronchial asthma, obstructive sleep apnea (OSA), etc [2].

The studies show family size, maternal health, mal food practices, poor diet, poverty, and physical inactivity are some of the determinants of being overweight in children under five [3]. A study shows that the determining factors are household wealth, a child's dietary diversity, and maternal BMI and education [4]. Earlier studies are mainly based on the household characteristics of the child and their association with being overweight.

Studies are also available where the positive association of overweight children with maternal weight in the preconception stage and maternal weight during childhood is observed [5]. This study

has been designed to find out overweight and central obesity in women of reproductive age (15-49 years) and overweight in children below five years of age.

Among the obesity anthropometric indices, the waist-hip ratio is considered superior to Body Mass Index (BMI) in predicting obesity-related diseases [6]. Abdominal obesity showing high WHR has been proven to predict diseases such as hypertension, coronary heart disease, non-insulin-dependent diabetes, and stroke [7]. Hence the WHR is considered a parameter for this study.

This study is mainly designed to understand the percentage of women with overweight, and high-risk WHR, and the percentage of under-five overweight children.

2. Methods

2.1. Type of the Study—Secondary Data Analysis

2.2. Study Population

A population of 724,115 women in the age group of 15-49 years were covered in this study. Women as well as the under-five children population were divided into two sub-samples for study, urban and rural. The waist and hip circumference measurements were provided by using Gulick tapes for measurements of abdominal obesity. Cut-offs for high-risk WHR (≥ 0.85 cm) have been set for women.

2.3. Database USED for Study

The study data was obtained from the National Family Health Survey-5 (NFHS-5) from the Ministry of Health and Family Welfare (MoHFW), Government of India [8]. This national-level survey was carried out in two phases- the first phase was for 17 states and 5 Union territories from 17 June 2019 to 30 January 2020, and the second phase has been completed in 11 States and 3 UTs from 2 January 2020 to 30 April 2021.

2.4. Study Approval

This study is based on the publicly available data of NFHS5 on the Ministry of Health and Family Welfare website, in India. There is no identifiable information on the participants is given. As per the data provided, the ethical approval for the NFHS-5 surveys is obtained from the ethics review board of the International Institute for Population Sciences, Mumbai, India. These surveys are reviewed and approved by the ICF Institutional Review Board, USA. Informed written consent for participation in this survey is obtained from the respondents during the survey. Each individual's approval is sought before the patient interview, as per the consistent methodology followed in these national surveys.

2.5. Study Variables

The primary outcome variable or dependent variable in this study is the percentage of under-five overweight children. Whereas the independent variables or explanatory variables are the percentage of overweight women and percentage of women with high-risk WHR.

2.6. Statistical Analysis

Descriptive statistical analysis, mean, median, and mode were calculated for the collected data. Simple linear regression, Multiple linear regression, and Pearson correlation coefficient were calculated to understand the relation between the dependent variable, the percentage of under-five overweight children, and independent variables- the percentage of overweight women and women with high-risk WHR. Simple, easy-to-use, online statistical software Stats.Blue (<https://stats.blue/>) was used for all the above-said statistical analysis.

3. Results

Descriptive analysis shows, that compared to NFHS4 (23.6%), the percentage of women who are overweight has increased in NFHS5 (27.7%). Similarly, the percentage of overweight children has increased from 2.9% to 4.9% in NFHS4 to NFHS5 (Table 1). When the mean values are compared for urban-rural difference for percentage of overweight women, percentage of women with central obesity, and percentage of overweight children; all the variables had higher values in urban areas compared to rural ones (Figure 1).

Table 1. State & Union Territories wise data on study parameters.

State	Overweight Women (%)				Women with High Risk WHR (%)				Overweight Children (%)			
	U	R	T5	T4	U	R	T5	T4	U	R	T5	T4
Jammu & Kashmir	33.4	27.9	29.3	29.3	89.2	87.3	87.8	--	10.8	9.3	9.6	5.7
Himachal Pradesh	38.3	29.2	30.4	28.6	60.3	62.1	61.9	--	5.4	5.7	5.7	1.9
Punjab	44.3	38.8	40.8	31.3	73.0	72.6	72.8	--	4.4	4.0	4.1	2.3
Uttarakhand	39.1	25.4	29.7	20.4	62.8	63.0	62.9	--	4.4	3.9	4.1	3.5
Haryana	37.5	30.9	33.1	21.0	64.6	61.7	62.6	--	3.3	3.3	3.3	3.1
Delhi	41.2	44.6	41.3	33.5	67.6	69.0	67.7	--	4.0	4.5	4.0	1.2
Uttar Pradesh	30.6	18.3	21.3	16.5	61.7	55.2	56.8	--	3.6	2.9	3.1	1.5
Chandigarh	43.9	--	44.0	41.5	60.4	--	60.7	--	1.9	--	1.9	1.1
Ladakh	28.5	28.2	28.3	16.3	88.6	85.8	86.3	--	17.0	12.4	13.4	4.0
Andhra Pradesh	44.4	32.6	36.3	33.2	52.7	47.2	48.9	--	3.0	2.6	2.7	1.2
Karnataka	37.1	25.6	30.1	23.3	46.8	43.9	45.1	--	3.8	2.9	3.2	2.6
Kerala	40.4	36.0	38.1	32.4	71.1	70.2	70.7	--	3.8	4.2	4.0	3.4
Tamil Nadu	46.1	35.4	40.4	30.9	58.3	53.8	55.9	--	5.1	3.7	4.3	5.0
Telangana	41.7	23.8	30.1	28.6	47.5	42.3	44.1	--	4.2	3.0	3.4	0.7
Puducherry	47.6	43.2	46.2	36.7	55.4	52.0	54.3	--	2.7	6.5	3.8	2.2
Andaman & Nicobar	41.7	35.7	38.1	31.8	72.2	80.7	77.3	--	5.7	5.2	5.4	3.0
Lakshwadeep	34.2	31.0	33.5	40.6	69.1	66.2	68.4	--	10.0	11.8	10.5	1.6
Bihar	25.2	14.2	15.9	11.7	68.4	58.8	60.3	--	2.2	2.4	2.4	1.2
Jharkhand	21.6	8.6	11.9	10.3	66.4	56.2	58.7	--	2.8	2.8	2.8	1.5
Odisha	40.1	19.2	23.0	16.5	70.7	61.3	63.0	--	5.5	3.2	3.5	2.6
West Bengal	27.9	20.3	22.7	19.9	80.1	72.1	74.7	--	6.0	3.6	4.3	2.1
Rajasthan	20.6	10.5	12.9	14.1	62.1	58.1	59.0	--	3.9	3.1	3.3	2.1
Maharashtra	29.6	18.3	23.4	23.4	51.5	38.6	44.5	--	5.2	3.4	4.1	1.9
Gujrat	30.4	17.0	22.6	23.7	47.2	41.2	43.7	--	4.6	3.5	3.9	1.9
Goa	38.1	33.1	36.1	33.5	51.1	51.0	51.1	--	2.2	3.6	2.8	3.7
Dadara, Nagar Haveli, Diu & Daman	34.0	20.3	26.8	23.3	46.2	44.7	45.4	--	1.2	2.5	1.9	3.9
Chattisgarh	23.1	11.3	14.1	11.9	64.5	52.5	55.4	--	5.7	3.6	4.0	2.9
Madhya Pradesh	26.0	13.0	16.6	13.6	42.0	39.9	40.5	--	1.8	2.1	2.0	1.7
Arunachal Pradesh	28.9	22.9	23.9	18.8	66.6	69.4	68.9	--	9.6	9.7	9.7	4.9
Assam	23.8	13.6	15.2	13.2	66.6	67.3	67.2	--	8.0	4.5	4.9	2.3
Manipur	39.0	31.0	34.1	26.0	69.7	63.1	65.7	---	2.9	3.6	3.4	3.1
Meghalaya	17.9	9.7	11.5	12.2	55.7	61.9	60.6	--	4.2	4.0	4.0	3.9
Mizoram	29.7	16.9	24.2	21.0	47.8	47.3	47.6	--	12.1	8.1	10.0	4.2
Nagaland	17.1	13.0	14.4	16.2	59.6	63.4	62.0	--	4.8	4.9	4.9	3.8
Sikkim	41.0	30.8	34.7	26.7	71.9	78.0	75.6	--	3.5	12.2	9.6	8.6
Tripura	29.2	18.4	21.5	16.0	67.7	60.4	62.5	--	9.3	7.8	8.2	3.0
Mean	33.7	23.6	27.7	23.6	62.7	58.3	60.9	--	5.2	4.8	4.9	2.9
Median	34.1	23.4	28.8	23.3	63.7	60.9	61.3	--	4.3	3.7	4.0	2.6
Mode	41.7	18.3	30.1	28.6	66.6	87.3	87.8	--	4.4	3.6	4.0	1.9

U-Urban R-Rural T5-NFHS5 (2019-21) T4-NFHS4 (2015-16) W-H-R-Waist to Hip Ratio.

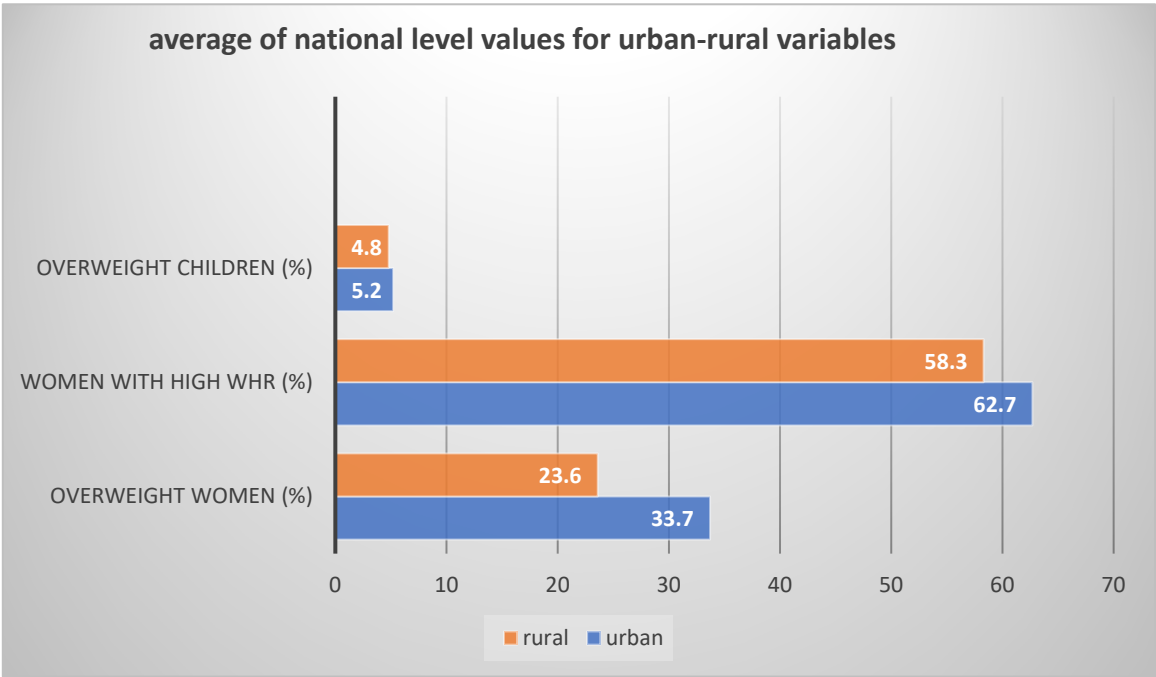


Figure 1. average of national-level values for overweight women and children.

Simple linear regression of our data for the independent variable overweight in women and dependent variable overweight in children shows no straight-line relationship between overweight women and overweight children. The regression line is $\text{overweight children} = 0.0099 \cdot \text{overweight women} + 4.6198$ (CI- 95%, $p = 0.8421$). It shows that 84.2% of samples are far away from zero.

Simple linear regression for the dependent variable overweight children and independent variable central obesity in women shows no straight-line relationship. Here β coefficient is 0.1366 (CI-95%, p value= 0.0003)

Multiple linear regression analysis for dependent variable percentage of overweight children and independent variables overweight women and women with central obesity shows regression equation, $\text{percentage of overweight children} = -3.0448 - 0.0202 \cdot \text{percentage of overweight women} + 0.1397 \cdot \text{percentage of women with central obesity}$.

The Pearson correlation coefficient value of R is 0.0344 for the percentage of overweight women and the percentage of overweight children. Although technically it is a positive correlation, the relationship between variables is weak. For the variables, the percentage of overweight children and the percentage of women with central obesity, the Pearson correlation coefficient (R) is 0.5662. This is a moderate positive correlation, which means there is a tendency for a high independent variable, the percentage of women with central obesity goes with a high dependent variable percentage of overweight children.

4. Discussion

This study shows a moderate positive correlation between women with high-risk WHR and overweight under-five children. Factors like maternal employment [9], family structure [10], childhood day and education centres [11], and their effect on the weight of children are studied earlier. At the same time, the earlier studies on the relationship between a parent's obesity and a child's overweight show a positive relation [12]. This study is different as the percentage of women with overweight and high-risk WHR, along with the rate of overweight children is studied. Our findings suggest that with an increasing percentage of women with high-risk WHR, the percentage of overweight children below five will increase.

Our study shows that more urban women are overweight than rural ones, similar to earlier works [13]. A survey of the Nigerian women population shows 35.5% overweight women in urban areas, compared to 21.1% in rural areas. This study shows characteristics of women like household wealth, employment, old age, higher education, marital status, number of children, and contraceptive use are the determinants behind the urban-rural divide of overweight women in reproductive age [14,15].

A similar study was conducted on Bangladeshi women to know the urban-rural obesity trend. This study highlighted the increasing obesity trend in cities is due to rapid urbanization, modern transport, fast and processed food, and a sedentary lifestyle [16].

Urbanization is the most important contributor to being overweight due to access to unhealthy food and less physical activity [17]. The study carried out in Indian urban women of reproductive age for the period 2005-2021 also states the prevalence of obesity has increased in urban India from 23% in 2005-06 to 33% in 2019-21 [18].

As per our study, compared to NFHS4, the percentage of overweight women is increasing at the country level. Similar observations were seen in analyses conducted in Tanzania [19], Kenya [20], and Sub-Saharan African countries like Eswatini, Mauritania, South Africa, Gabon, Lesotho, and Ghana [21].

Overweight children under five years of age are not an urban phenomenon, it is seen in rural also. Maternal factors like age at the time of marriage, BMI, education, and media exposure are considered factors associated with under-five overweight children. Along with these factors, dietary diversity score, sex, age, birth weight, birth rank, and number of children are also the determining factors of childhood overweight [22].

Compared to NFHS4 data, the percentage of overweight children is increasing. A study was carried out on Chinese children to understand the urban-rural trend of childhood overweight for 29 years. It shows childhood obesity has been increasing continuously over the years in the country and though the percentage of overweight children is more in urban than rural, the gap between urban and rural is getting narrower [23]. Our study is important from a future point of view. Policies and interventions should be designed considering the rural children too.

This study shows high-risk waist-to-hip ratio in women is a mixed phenomenon observed in urban and rural women. The overall prevalence of central obesity was observed at 55% when five Indian cities were studied for central obesity in the urban women population [24]. The data analysis of our study shows an increasing trend of central obesity where 62.7% of urban women have high-risk WHR whereas 58.3% of rural women have high-risk WHR. A study carried out in the rural population of Meerut, India has supportive evidence for our finding that high-risk WHR is also a rural phenomenon [25].

Our study shows the percentage of overweight women and overweight children is growing over the period. An analysis carried out to study the prevalence of overweight in adults and children between 1990 to 2015 for 195 countries shows a rising trend of obesity. In more than 70 countries, this trend has doubled [26].

The analysis of our data shows the percentage of women with central obesity is far higher compared to the percentage of overweight women. This is seen in urban as well as rural women population. Overweight or obesity is an important determinant of cardiovascular disease (CVD) and cardiometabolic disease (CMD). High-risk WHR has a positive correlation with the risk of infertility [27] and CVD risk [28]. Our findings highlight the importance of maintaining abdominal fat to maintain healthy WHR levels in women mainly of younger age.

5. Limitations of Study

There is no data available for NFHS4 for high-risk WHR so we could not compare it with values of NFHS5. This study is based on secondary data so all the limitations of secondary data apply to this study.

6. Conclusion and Policy Implications

In the present study, we examined the percentage of increase in the overweight of under-five children and women in the reproductive age of 15-49 yrs. Overweight is showing an increasing trend. There is a moderate positive correlation between central obesity and overweight in the under-five children. Overweight in women and children is becoming a public health issue. Strategically designed awareness programs preferably in regional languages may help to reduce the risk. To prevent overweight, women should focus on healthy diets and physical activity.

7. Research Highlights

- This study shows a moderate positive correlation between central obesity in women and overweight in under-five children.
- More urban women are overweight as compared to rural ones. Overweight in children is a mixed phenomenon.
- Compared to NFHS4, the percentage of overweight women and the percentage of overweight under-five children is increasing.
- High-risk Waist-Hip-Ratio is seen in urban as well as in rural women.

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Ethics approval and consent to participate: This study is based on publicly available secondary data so ethical approval is not necessary.

References

1. <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>
2. Balasundaram P, Krishna S. Obesity Effects on Child Health. [Updated 2023 Apr 10]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK570613/>
3. Ayele, B.A., Tiruneh, S.A., Ayele, A.A. *et al.* Prevalence and determinants of overweight/obesity among under-five children in sub-Saharan Africa: a multilevel analysis. *BMC Pediatr* 22, 585 (2022). <https://doi.org/10.1186/s12887-022-03645-z>
4. Bishwajit, G., & Yaya, S. (2020). Overweight and obesity among under-five children in South Asia. *Child and Adolescent Obesity*, 3(1), 105–121. <https://doi.org/10.1080/2574254X.2020.1769992>
5. Mannino A, Sarapis K, Moschonis G. The Effect of Maternal Overweight and Obesity Pre-Pregnancy and During Childhood in the Development of Obesity in Children and Adolescents: A Systematic Literature Review. *Nutrients*. 2022 Dec 2;14(23):5125. doi: 10.3390/nu14235125. PMID: 36501155; PMCID: PMC9739272.
6. Srikanthan P, Seeman TE, Karlamangla AS. Waist-hip-ratio as a predictor of all-cause mortality in high-functioning older adults. *Ann Epidemiol*. 2009 Oct;19(10):724-31. doi: 10.1016/j.annepidem.2009.05.003.
7. Molarius A, Seidell JC, Sans S, Tuomilehto J, Kuulasmaa K. Waist and hip circumferences, and waist-hip ratio in 19 populations of the WHO MONICA Project. *Int J Obes Relat Metab Disord*. 1999 Feb;23(2):116-25. doi: 10.1038/sj.ijo.0800772.
8. https://main.mohfw.gov.in/sites/default/files/NFHS-5_Phase-I.pdf
https://main.mohfw.gov.in/sites/default/files/NFHS-5_Phase-II_0.pdf
9. Emla Fitzsimons, Benedetta Pongiglione. The impact of maternal employment on children's weight: Evidence from the UK. *SSM - Population Health*, Volume 7, April 2019, 100333
10. Stahlmann K, Lissner L, Bogl LH, Mehlig K, Kaprio J, Klosowska JC, Moreno LA, Veidebaum T, Solea A, Molnár D, Lauria F. Family structure in relation to body mass index and metabolic score in European children and adolescents. *Pediatric obesity*. 2022 Dec;17(12):e12963.
11. Herr RM, De Bock F, Diehl K, Wiedemann E, Sterdt E, Blume M, Hoffmann S, Herke M, Reuter M, Iashchenko I, Schneider S. Associations of individual factors and early childhood education and care

- (ECEC) centres characteristics with preschoolers' BMI in Germany. *BMC Public Health*. 2022 Jul 26;22(1):1415.
12. Tchicaya A, Lorentz N. Relationship between children's body mass index and parents' obesity and socioeconomic status: A multilevel analysis applied with Luxembourg data. *Health*. 2014 Sep 30;6(17):2322.
 13. Kudumula Sricharan Reddy., Prabhakaran Dorairaj., Purv Shah., Bijaya Bikram Shah. Difference in body mass index and waist: Hip ratios in North Indian rural and urban populations. September 2002 *Obesity Reviews* 3(3):197-202
 14. Baruwa, O.J., Gbadebo, B.M., Adeleye, O.J. *et al.* Decomposing the rural-urban disparities in overweight and obesity among women of reproductive age in Nigeria. *BMC Women's Health* **23**, 680 (2023). <https://doi.org/10.1186/s12905-023-02813-2>
 15. Kumar, P., Mangla, S. & Kundu, S. Inequalities in overweight and obesity among reproductive age group women in India: evidence from National Family Health Survey (2015–16). *BMC Women's Health* **22**, 205 (2022). <https://doi.org/10.1186/s12905-022-01786-y>
 16. Islam F, Kathak RR, Sumon AH, Molla NH (2020) Prevalence and associated risk factors of general and abdominal obesity in rural and urban women in Bangladesh. *PLoS ONE* 15(5): e0233754. <https://doi.org/10.1371/journal.pone.0233754>
 17. Thapa R, Dahl C, Aung WP, Bjertness E. Urban-rural differences in overweight and obesity among 25-64 years old Myanmar residents: a cross-sectional, nationwide survey. *BMJ Open*. 2021 Mar 2;11(3):e042561. doi: 10.1136/bmjopen-2020-042561. PMID: 33653748; PMCID: PMC7929804.
 18. Singh, A., Let, S., Tiwari, S. *et al.* Spatiotemporal variations and determinants of overweight/obesity among women of reproductive age in urban India during 2005-2021. *BMC Public Health* 23, 1933 (2023). <https://doi.org/10.1186/s12889-023-16842-x>
 19. Kikula AI, Semaan A, Balandya B, *et al.* Increasing prevalence of overweight and obesity among Tanzanian women of reproductive age intending to conceive: evidence from three Demographic Health Surveys, 2004-2016. *Journal of Global Health Reports*. 2023;7:e2023062. doi:10.29392/001c.87443
 20. Mkuu RS, Epnere K, Chowdhury MAB. Prevalence and Predictors of Overweight and Obesity Among Kenyan Women. *Prev Chronic Dis* 2018;15:170401. DOI: <http://dx.doi.org/10.5888/pcd15.170401>
 21. Owobi OU, Okonji OC, Nzopotam CI, Ekholuenetale M. Country-Level Variations in Overweight and Obesity among Reproductive-Aged Women in Sub-Saharan Countries. *Women*. 2022; 2(4):313-325. <https://doi.org/10.3390/women2040029>
 22. Saha J, Chouhan P, Ahmed F, Ghosh T, Mondal S, Shahid M, Fatima S, Tang K. Overweight/Obesity Prevalence among Under-Five Children and Risk Factors in India: A Cross-Sectional Study Using the National Family Health Survey (2015-2016). *Nutrients*. 2022 Sep 1;14(17):3621. doi: 10.3390/nu14173621. PMID: 36079879; PMCID: PMC9460849.
 23. Ying-Xiu Zhang, Zhao-Xia Wang, Jin-Shan Zhao, Zun-Hua Chu, Prevalence of Overweight and Obesity among Children and Adolescents in Shandong, China: Urban–Rural Disparity, *Journal of Tropical Pediatrics*, Volume 62, Issue 4, August 2016, Pages 293–300, <https://doi.org/10.1093/tropej/fmw011>
 24. Singh RB, Ghosh S, Beegom R, *et al.* Prevalence and Determinants of Central Obesity and Age-Specific Waist: Hip Ratio of People in Five Cities: The Indian Women's Health Study. *Journal of Cardiovascular Risk*. 1998;5(2):73-77. doi:10.1177/174182679800500201
 25. Garg M, Bansal R, Gupta M, Gupta CK. Prevalence of hypertension and its association with stress, Indian diabetes risk score and obesity in rural population of Meerut. *Indian J Comm Health*. 2020;32(1):62-66.
 26. The GBD 2015 Obesity Collaborators, 2017. Health Effects of Overweight and Obesity in 195 Countries over 25 Years. *N Engl J Med* 2017;377:13-27
 27. Jun Lai, Xinqing Li, Zongyan Liu, Yuanyue Liao, Zuomiao Xiao, Yufeng Wei, Yongxiao Cao; Association between waist-hip ratio and Female Infertility in the United States: Data from National Health and Nutrition Examination Survey 2017–2020. *Obes Facts* 2024; <https://doi.org/10.1159/000538974>
 28. Darbandi M, Pasdar Y, Moradi S, Mohamed HJJ, Hamzeh B, Salimi Y. Discriminatory Capacity of Anthropometric Indices for Cardiovascular Disease in Adults: A Systematic Review and Meta-Analysis. *Prev Chronic Dis* 2020;17:200112. DOI: <http://dx.doi.org/10.5888/pcd17.200112>external icon.

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