



## OBESITY AN EMERGING PUBLIC HEALTH ISSUE: BURDEN AND RISK FACTORS OF OVERWEIGHT AND OBESITY AMONG WOMEN IN LAHORE, PAKISTAN.

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### Abstract Background

In contemporary days, obesity is a common medical issue impacting equally children as well as adults in both genders. Previously, Obesity was considered a medical problem in developed countries however these countries have also suffered badly because of low socioeconomic scenarios in the last two decades. The study examined the prevalence and determinants of overweight and obesity among women of reproductive age in Lahore, Pakistan.

### Methods

This study was based on the National Nutritional Survey (NNS) 2018 of Pakistan. Qualitative and quantitative research methods were utilized for data collection in this survey. A total sample of 1,805 nonpregnant women of reproductive age (WRA) from Lahore was analyzed using univariate analysis and multiple logistic regression model.

### Results

The prevalence of overweight and obesity among reproductive-aged women of Lahore was found nearly 50% with a comparatively higher portion of overweight women 28.1% than the women with obesity nearly 21.4%. Factors such as wealth quintile, marital status, age, and occupational status were found to be significantly associated with the risk of developing overweight and obesity. Prevalence of overweight and obesity was noted as high among women in the older age group (45-49 years), having primary level education, housewives and married with over five pregnancies and deliveries.

### Conclusion

A high prevalence of overweight and obesity was found among women of reproductive age in Lahore as compared to the prevalence rate at the national level. Targetted efforts and strategies are required to address this significant public health issue to reduce the risk of NCDs among women of reproductive age.

**Key Words:** Women; reproductive age; Obesity; Prevalence; Overweight

## Background

Obesity is a significant public health concern that can be prevented without complex clinical interventions. According to world obesity data 2017, obesity was the eighth leading cause of death globally and this trend indicated an increase of 4.5% in death rate than the year 1990 [1] and shared a significant portion of the global burden of disease [2]. Obesity is described as a complex multifactorial disease that causes extra accumulation of fat in the body and may lead to very serious consequences including mortality [3]. Obesity was defined based on the Body Mass Index (BMI). According to the World Health Organization, adults with a BMI  $\geq 25$  are overweight and BMI  $\geq 30$  are suffering from obesity.

Over the last four decades, the global prevalence of overweight and obesity showed a remarkably increased trend and between 1980 to 2013 the combined prevalence of overweight and obesity presented as 27.5% for adults and 47.1% for children. An increased trend of overweight and obesity was also observed in women during this stipulated period from 29.8% to 38.0% [4]. It is one of the leading risk factors for other non-communicable diseases such as diabetes, cardiovascular diseases, musculoskeletal disorders, and some forms of cancers such as endometrial, liver, gallbladder, prostate, ovarian, breast, kidney, and colon cancer [4].

Previously overweight and obesity were only associated with developed and high-income countries, but contemporary research has shown that these conditions also become significant public health issues in developing or low-income countries, particularly in urban areas [5]. Obesity rates are increasing worldwide at a pace that after the 1980s has doubled, and in the current scenario one-third of the population is declared overweight and suffering from obesity [6]. Irrespective of region, obesity trends were equally observed among all age groups, however, it was more prevalent among old-aged women [7]. Compared to males, due to physiological, anatomical, hormonal, and various social and health determinants, females are more vulnerable to underweight, obesity, and overweight conditions [8] [9] [10] [11]. Therefore, they are more prone to have medical conditions such as infertility and maternal complications including abortion, preterm birth, and neonatal mortality [12] [13] [14] [15]. Additionally, obesity has negative implications on mental health linked with stigmatization and criticism, especially in women.

In Pakistan around 58% and 44% of people were overweight and suffering from obesity, respectively in 2020, and it is the 3<sup>rd</sup> largest country with 33 million diabetic patients [16]. Major contributing factors that lead to a higher rate of obesity in Pakistan are rapid environmental changes, lifestyle modification, poor socioeconomic conditions, usage of high-density diets, and physical inactivity. Pakistani women of urban areas have an increased obesity tendency than women of rural areas. Girls were reported to have a high obesity rate in all age groups as compared to boys [17].

Some evidence is available on obesity trends among all age groups and sexes, however, there is little evidence about the obesity prevalence and risk factors among females in Pakistan. Therefore, this study aims to identify the prevalence and major contributing factors of obesity and overweight among females of reproductive age in Lahore, Pakistan.

## Methods

### Study design and data source

Data used in this study was derived from the National Nutritional Survey (NNS) 2018. It was a national cross-sectional survey at the household level and is considered to be the largest-ever survey conducted in Pakistan. For this research, the data of NNS 2018 was obtained from the Ministry of National Health Services and Coordination (MoNHSR & C) with official consent regarding the use

of data. Before the study, the ethical approval was obtained from the Institutional Review Board (IRB), University of the Punjab, Lahore.

#### Sampling technique and population

The NNS 2018 covered all provinces and regions including Islamabad Capital Territory (ICT) of Pakistan. The sample of the survey was designed on the district level estimates while the study groups included were comprised of children aged (0-59 months & 6-12 years), women of reproductive age (WRA) aged (15-49 years) and adolescent boys and girls aged (10-19 years). A mixed research methodology was applied in this survey, wherein district and regional levels data was collected through quantitative and qualitative methods, respectively. Two-stage stratified sampling technique was used to select the study population.

Before data collection, survey teams completed the mapping and listing of households. A total of 5,507 Primary Sampling Units comprised of 100,304 households from all 156 districts were interviewed. The overall response rate was 94.9 %. Among women of reproductive age (WRA), a total of 123,092 women were assessed for their nutrition status and dietary diversity, of them 46.4% had normal BMI, 14.5% were underweight whereas 24.2% and 13.9% were overweight and suffering from obesity, respectively.

#### Data collection and screening

Data of WRA from district Lahore, Pakistan collected during NNS 2018 was acquired through digital consent from MoNHSR & C. Seca 874 U electronic scale (Hamburg Germany) was used for measurement of weight to the nearest 0.1 kg, and height boards (3 slab) was used for monitoring height, to the nearest 0.1 cm. All the measurements were performed by trained staff. These instruments were calibrated daily by the team supervisors before the initiation of data collection. For anthropometric measurements, Standardized Monitoring and Assessment of Relief and Transitions (SMART) methodology was applied.

Before carrying out the actual analysis for this research, the screening of data was performed by the researcher. The dataset was searched for available predictor variables and weight & height variables by running frequencies. A total sample of WRA (aged 15-49 years) with weight and height measurements was found to be n=1885. The analysis was limited to non-pregnant women aged 15-49 years with valid weight and height measurements and the total sample of non-pregnant women, of district Lahore was n= 1805. Given that pregnant women gain natural weight during pregnancy, they were excluded from this study to avoid misrepresentation of overweight and obesity prevalence estimates. Data Analysis

Data was analyzed by using the IBM SPSS version 20 statistical software. Outcome variables of this analysis were overweight and obesity while the predictor variables were extracted from WRA data of NNS 2018. These variables include wealth index quintile, age, education, marital status, parity, no of pregnancies, no of deliveries, occupational status, and BMI index (Table 1).

Categorical variables were defined as numbers and percentages whereas continuous variables were presented as mean  $\pm$  standard deviation (SD). To identify the factors associated with overweight and obesity, univariate analysis was performed by using the chi-square test. Significant variables identified through univariate analysis were included in the multiple logistic regression model. Results of multiple regression were presented in odds ratio (OR) at 95% confidence intervals and p-value  $\leq 0.05$  was considered statistically significant.

## Results

### Basic characteristics

The basic characteristics of study participants are demonstrated in Table 1. A total of 1,805 nonpregnant women were included in the analysis. The mean age ( $\pm$  SD) of the sample was 28.84 $\pm$

9.0 years. Among participants, about 61.7% were in the richest quintile and 29.0% of women had higher education.

Married women accounted for 68.4% and women having 1-4 children were 49.4%. About 36.2% of women were observed with no pregnancy and delivery at all and 70.7% of women were housewives. The mean BMI ( $\pm$  SD) of women was  $25.41 \pm 5.6$ , while 10.6% of women were underweight, 39.8% were normal weight, 28.1% were overweight, and 21.4% with obese.

**Table 1** Characteristics of non-pregnant reproductive-age women in Lahore, Pakistan. 2018 NNS (N<sup>w</sup> =1,805)

Variables		Frequency (%)
Wealth index quintile	Poorest	4 (0.2)
	Second	71 (3.9)
	Middle	183 (10.1)
	Fourth	433 (24)
	Richest	1114 (61.7)
Age Groups	15- 19 Years	309 (17.1)
	20 - 24 Years	399 (22.1)
	25 - 29 Years	327 (18.1)
	30 - 34 Years	241 (13.4)
	35 - 39 Years	248 (13.7)
	40 - 44 Years	183 (10.1)
	45 - 49 Years	98 (5.4)
Education	Illiterate	469 (26)
	Primary	173 (9.6)
	Middle	204 (11.3)
	Secondary	436 (24.2)
	Higher	523 (29)
Marital Status	Married	1235 (68.4)
	Widowed	30 (1.7)
	Divorced	9 (0.5)
	Separated	2 (0.1)
	Un-Married	529 (29.3)
P arity	No Child	664 (36.8)
	1-4 Children	892 (49.4)
	5 + Children	249 (13.8)
No of Time Pregnant	0	653 (36.2)
	1	157 (8.7)
	2	210 (11.6)
	3	238 (13.2)
	4	228 (12.6)

	5	138 (7.6)
	Greater than or Equal to 6	181 (10)
Delivery (No of Times)	0	653 (36.2)
	1	174 (9.6)
	2	219 (12.1)
	3	269 (14.9)
	4	241 (13.4)
	5	123 (6.8)
	Greater than or Equal to 6	126 (7)
Occupational Status	None	111 (6.1)
	Unskilled Manual Labor	34 (1.9)
	Skilled Manual Labor	41 (2.3)
	Sales And Services	7 (0.4)
	Professional	49 (2.7)
	Student	276 (15.3)

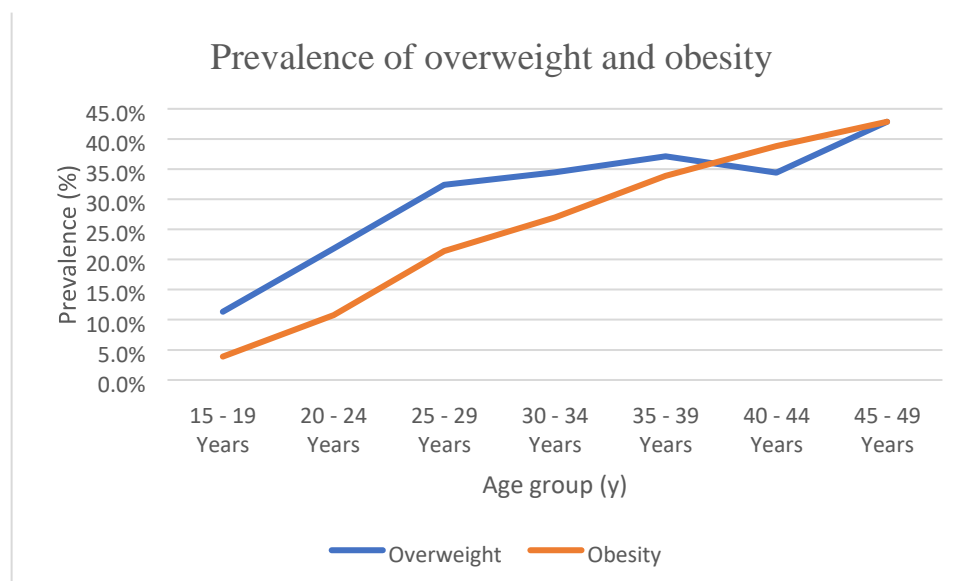
	Unemployed	5 (0.3)
	Housewife	1276 (70.7)
	Others (Specify)	6 (0.3)
BMI Index	Underweight (<18.5)	191 (10.6)
	Normal (18.5-24.9)	719 (39.8)
	Overweight (25.0-29.9)	508 (28.1)
	Obese (>=30)	387 (21.4)

N<sup>w</sup> = Total weighted count excluding pregnant women, NNS = *National Nutrition Survey*

#### Prevalence of overweight and obesity

The prevalence of overweight and obesity was 28.1% and 21.4%, respectively, thus, nearly half (49.5%) of women of reproductive age in Lahore were overweight and suffered from obesity (Table 2).

The prevalence of overweight and obesity increased with age, the highest among age group 45-49 years. (Figure 1). For overweight females, prevalence increased with age till 35-39 years. A decline was observed among the age group 40-44 years and then again, an increase in prevalence among the age group 45-49 years. However, in the case of obesity prevalence, a gradual increase was noted from the youngest age group, and a peak value was observed among the age group of 45-49 years.



**Figure 1:** Prevalence of overweight and obesity by different age groups

The prevalence of overweight and obesity was higher (30.70% and 22.35%) among the richest participants. The higher prevalence of overweight (32.37%) was noted in women having primary level education while illiterate participants had a higher prevalence of obesity (26.23%). The decline in overweight and obesity prevalence was observed with the increasing level of education. The prevalence of overweight and obesity was noted highest (34.66% and 27.69%) among women who were married compared to unmarried women. With a greater number of children, an increase in the prevalence of overweight and obesity was observed at the highest level (34.94% and 36.55%) in women having more than 5 children. Regarding the frequency of pregnancies and deliveries, increased prevalence of overweight (39.86% and 38.21% respectively) was observed among participants with 5 pregnancies and deliveries. Similarly, the obesity prevalence was found highest (38.12% and 38.10%) among women who had multiple pregnancies and deliveries i.e.  $\geq 6$ . Considering the occupational status, women who were housewives had a high prevalence of overweight and obesity (32.52% and 26.33% respectively), compared to students, unemployed and professional women.

**Table 2:** Prevalence of overweight and obesity among various characteristics in women of Lahore, Pakistan.

		Overweight		Obesity		Overweight/ Obesity	
		No. (%)	P Value	No. (%)	P Value	No. (%)	P Value
Total		508 (28.14)		387 (21.44)		895 (49.58)	
Wealth quintile			0.004		0.335		0.001
	Low	16 (21.33)		14 (18.67)		30 (40)	
	Middle	39 (21.31)		33 (18.03)		72 (39.34)	
	Fourth	111 (25.64)		91 (21.02)		202 (46.65)	
	Richest	342 (30.70)		249 (22.35)		591 (53.05)	

Age Groups			0.000		0.000		0.000
	15- 19 Years	35 (11.33)		12 (3.88)		47 (15.21)	
	20 - 24 Years	87 (21.80)		43 (10.78)		130 (32.58)	
	25 - 29 Years	106 (32.42)		70 (21.41)		176 (53.82)	
	30 - 34 Years	83 (34.44)		65 (26.97)		148 (61.41)	
	35 - 39 Years	92 (37.10)		84 (33.87)		176 (70.97)	
	40 - 44 Years	63 (34.43)		71 (38.80)		134 (73.22)	
	45 - 49 Years	42 (42.86)		42 (42.86)		84 (85.71)	
Education			0.541		0.025		0.014
	Illiterate	136 (29.00)		123 (26.23)		259 (55.22)	
	Primary	56 (32.37)		33 (19.08)		89 (51.45)	
	Middle	52 (25.49)		44 (21.57)		96 (47.06)	
	Secondary	125 (28.67)		94 (21.56)		219 (50.23)	
	Higher	139 (26.58)		93 (17.78)		232 (44.36)	
Marital Status			0.000		0.000		0.000
	Un-Married	69 (13.04)		33 (6.24)		102 (19.28)	
	Married	428 (34.66)		342 (27.69)		770 (62.35)	
	Widowed / Divorced / Separated	11 (26.83)		12 (29.27)		23 (56.1)	
Parity			0.000		0.000		0.000
	No Child	115 (17.32)		63 (9.49)		178 (26.81)	
	1-4 Children	306 (34.30)		233 (26.12)		539 (60.43)	
	5 + Children	87 (34.94)		91 (36.55)		178 (71.49)	
No of Time Pregnant			0.000		0.000		0.000
	0	110 (16.85)		59 (9.04)		169 (25.88)	
	1	58 (36.94)		25 (15.92)		83 (52.87)	
	2	69 (32.86)		54 (25.71)		123 (58.57)	
	3	76 (31.93)		63 (26.47)		139 (58.4)	
	4	82 (35.96)		73 (32.02)		155 (67.98)	
	5	55 (39.86)		44 (31.88)		99 (71.74)	
	Greater than or Equal to 6	58 (32.04)		69 (38.12)		127 (70.17)	
Delivery (No of Times)			0.000		0.000		0.000

	0	110 (16.85)		59 (9.04)		169 (25.88)	
	1	64 (36.78)		30 (17.24)		94 (54.02)	
	2	73 (33.33)		55 (25.11)		128 (58.45)	
	3	93 (34.57)		73 (27.14)		166 (61.71)	
	4	81 (33.61)		79 (32.78)		160 (66.39)	
	5	47 (38.21)		43 (34.96)		90 (73.17)	
	Greater than or Equal to 6	40 (31.75)		48 (38.10)		88 (69.84)	
Occupatio nal Status			0.000		0.000		0.000
	Student / Unemployed / None	55 (14.03)		25 (6.38)		80 (20.41)	
	Skilled / Unskilled Manual Labor - Sales & Services - Professional - Others	38 (27.74)		26 (18.98)		64 (46.72)	
	Housewife	415 (32.52)		336 (26.33)		751 (58.86)	

\*Age classification used in the National Nutritional Survey Report 2018 under section women of reproductive age.

Data are represented as value (percentage). Overweight: BMI  $\geq 25$  kg/m<sup>2</sup>; obesity: BMI  $\geq 30$  kg/m<sup>2</sup>; overweight/obesity: BMI  $\geq 25$  kg/m<sup>2</sup>

#### Determinants of overweight and obesity

To identify the significant determinants of combined overweight and obesity (overweight/obesity), all the significant variables in Table 2 were added to the multiple logistic regression model (Table 3). Regression analysis showed that wealth quintile, age, marital status, and occupational status were significantly associated with being overweight and suffering from obesity.

The odds of being overweight and obese were almost 2 times greater among the participants who were in the richest quintile (OR=1.913, P < 0.05) than those who were in the low quintile. Regarding age, except women aged 20-24 years, women in all other higher age groups (25-29 years OR=2.494, P < 0.001), 30-34 years OR=3.140, P < 0.001), 35-39 years (OR=4.770, P < 0.001), 40-44 years (OR=5.164, P < 0.001) and 45-49 (OR=11.538, P < 0.001)) had a greater correlation with developing overweight and obesity as compared to women aged 15-19 years. Regarding marital status, the odds of being overweight and having obesity were approximately 2 times higher among women who were married (OR=2.027, P < 0.05) as compared to unmarried women. The likelihood of being overweight and suffering from obesity is 1.5 times greater among women who were housewives (OR=1.584, P < 0.05) than women who were students or unemployed.

**Table 3:** Factors associated with overweight/obesity by multivariate logistic Regression analysis in women of Lahore, Pakistan.

		Overweight / Obesity	
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		OR (95% CI)	P Value
W ealth Quantile	Low	1	
	Middle	1.192 (0.646~2.200)	0.573
	Fourth	1.454 (0.829~2.551)	0.192
	Richest	2.105 (1.207~3.672)	0.009
Age Groups			
	15 -19 Years	1	
	20 - 24 Years	1.463 (0.943~2.270)	0.090
	25 - 29 Years	2.494 (1.527~4.074)	0.000
	30 - 34 Years	3.140 (1.841~5.355)	0.000
	35 - 39 Years	4.770 (2.742~8.298)	0.000
	40 - 44 Years	5.164 (2.881~9.256)	0.000
	45 - 49 Years	11.583 (5.421~24.75)	0.000
Education			
	Illiterate	1	
	Primary	1.064 (0.710~1.595)	0.763
	Middle	0.955 (0.644~1.414)	0.817
	Secondary	1.267 (0.914~1.756)	0.155
	Higher	1.014 (0.728~1.413)	0.933
Marital Status			
	Un-Married	1	
	Married	2.027 (1.221~3.366)	0.006
	Widowed / Divorced / Separated	1.271 (0.560~2.881)	0.566
Parity			
	No Child	1	0.000

	1-4 Children	0.300 (0.0570~1.573)	0.154
	5 + Children	0.348 (0.055~2.194)	0.261
No of Time Pregnant			
	0	1	
	1	0.676 (0.197~2.323)	0.534
	2	0.892 (0.284~2.799)	0.844
	3	0.742 (0.277~1.987)	0.552
	4	1.520 (0.594~3.894)	0.383
	5	1.263 (0.491~3.249)	0.629
	Greater than or Equal to 6	1.325 (0.738~2.376)	0.346
Delivery (No of Times)			
	0	1	
	1	1.603 (0.576~4.465)	0.366
	2	1.627 (0.667~3.967)	0.285
	3	1.589 (0.798~3.164)	0.188
	4	0 (0~0)	0.000
	5	1.365 (0.598~3.120)	0.460
	Greater than or Equal to 6	0 (0~0)	0.000
Occupational Status			
	Student / Unemployed / None	1	
	Skilled / Unskilled Manual Labor - Sales & Services - Professional - Others	1.431 (0.866~2.363)	0.162
	Housewife	1.548 (1.052~2.276)	0.026

Data are represented as OR (95% CI). Overweight/Obesity BMI  $\geq 25$  kg /m<sup>2</sup> OR was calculated by multiple logistic regression analysis. OR: odds ratio; CI: confidence interval.

## Discussion

Lahore is the second largest city and capital of the province of Punjab. It is famous for its rich culture and festivals. The present study is probably the first attempt to examine the prevalence of obesity and its associated risk factors, particularly among reproductive-age women of Lahore. The prevalence of overweight and obesity was 28.1% and 21.4% respectively among women in Lahore. Prevalence of overweight in Punjab and at national levels was 45.8% and 24.2% respectively, while obesity prevalence was 25.6% and 13.9 % respectively according to NNS 2018. The findings of our study showed a high rate of overweight and obesity as compared to national-level data [18].

The data reported from other studies conducted in Pakistan showed varied results; a study based on the Pakistan Panel Household Survey (PPHS-2010) indicated that the prevalence of overweight or obesity was 30.2% among women [19] which is comparable with our study results. Whereas a study conducted in northern areas of Pakistan showed a 14.1% prevalence of overweight and obesity in women [20]. Our findings related to overweight (28.1%) are also comparable with previously published research on Chinese populations [21] however obesity rate was higher in Pakistani women as compared to China. These prevalence rates of overweight and obesity were observed low in studies conducted in India [22] and Ethiopia [23]. Evidence suggests that the prevalence of overweight and obesity varies between different countries due to socioeconomic status and environmental health factors e.g. climate, diet and physical activity, etc.

Our study revealed that factors such as older age, marital status/married women, higher wealth index, and housewife were significantly associated with overweight and obesity; however significant association was not found between education, number of pregnancies, or deliveries. We found that aging contributes positively to a higher prevalence of overweight and obesity which is in line with the findings of other studies [24] [25] [30]. The association of older age with overweight and obesity could be due to hormonal changes and low physical activity. This correlation partly can be explained as young women in comparison to older pay more attention to their body weight, probably due to the societal pressure to maintain slim Figures [26]. Our findings implied that in Lahore, women aged above 45 years should be a priority group for any obesity-related health promotion, prevention, and management programs.

Consistent with the findings of other studies, the results of our study revealed that women in the richest quintile have a high tendency to be overweight and suffer from obesity [27] [28] [30] [32]. However, this finding is not in line with some studies of developed countries that showed a negative association between obesity and socioeconomic status [23] [30] [31]. In developing countries, women in the rich wealth quintile adopt unhealthy lifestyles than women in low wealth status which ultimately results in increased weight and obesity. Working women were also at a greater risk of obesity and overweight due to less attention on health and diet [32] [33].

Our study found that the marital status of women was associated with an increased prevalence of overweight and obesity which is consistent with previous studies [34] [35] [30]. Women usually gain weight during pregnancy and this increased weight persists even after the delivery because, in the postpartum period, women are offered high-energy food [30]. This increased weight could be linked to a sedentary lifestyle due to the likelihood of higher parity among married women [30]. There is a probability that gestational weight gain could be sustained for a lifetime if women do not lose weight during the postpartum period [36]. Compared to married, unmarried women, pay more attention to their body weight by regular exercise and eating healthy food, which decreases the likelihood of getting overweight and suffering from obesity [37]. In our findings, women living without partners (widowed, divorced, and separated) had less prevalence of overweight and obesity compared to married women which is consistent with the previous study. It is found that marital transitions could

be linked with changes in body weight in addition to marital status. Women always remained on the verge of criticism and stigmatization associated with their bodyweight especially unmarried women. Further research is needed to explore the relationship between marital transition and marital status with body weight in our study area.

We found an association between occupation and overweight and obesity. This study shows that housewives had high rates of overweight and obesity compared to professionals, unemployed, and students which is consistent with other studies [38] [39]. The high prevalence of overweight and obesity among housewives could be due to factors such as dietary habits, socioeconomic status, and lifestyle [40]. In our study, the level of education was not found to be a contributing factor for overweight and obesity, and similar results were observed in the literature also [28] [40]. On the contrary, some studies showed an association between education level and overweight and obesity [41] [30] [36]. Although marital status was positively associated with overweight and obesity, however parity, number of pregnancies and deliveries did not show significant association in our analysis. Overweight women with obesity are at greater risk of acquiring serious complications and non-communicable diseases. Therefore, systematic and focused efforts are required to address this important public health issue. Limitations

The major strength of this study is that nationally representative data from NNS 2018 was used. The NNS was conducted by utilizing standardized data collection protocols with trained staff, validated equipment, and structured questionnaires. The largest sample size and high response rate of NNS are also considered strengths of our study. Despite many strengths, there are also some limitations of this study. First, our study was a cross-sectional design therefore causal relationship cannot be established due to a lack of evidence about some observed factors. The second major factor that could contribute to overweight and obesity such as physical activity and dietary habits, are not included due to the limitation of the dataset. Third, no data was available on central obesity that includes waist/hip circumference and waist-to-hip ratio.

## Conclusion

This study showed that the prevalence of overweight and obesity among WRA in our study area was high as compared to national-level data. Major contributing factors identified are age, wealth quintile, marital status, and occupation. Older women, those with the richest quintile, women who are married, and those who are housewives, are observed to have a higher prevalence of overweight and obesity. Increased body weight could lead to the development of other serious diseases, effects on maternal health, and also negative implications on mental health due to societal pressure and norms. There is a dearth of research highlighting the increasing trend of overweight and obesity among the Pakistani population, especially WRA. This Public health issue shall be brought under control through coordinated efforts of public health professionals appropriately using professional approach.

Therefore, we performed the analysis of Pakistan's largest nationally representative Nutritional Survey data to create the baseline for establishment of future strategies, to cope with this escalating public health issue among Pakistani women. There is also a need to perform more in-depth research that covers behavioral factors related to lifestyle modifications, nutritional history, and marital transitions. Predictors of central obesity such as waist and hip circumference are recommended to be part of future studies conducted on overweight and obesity among women.

## Abbreviations:

BMI: Body Mass Index

NNS: National Nutritional Survey

MoNHSR & C: Ministry of National Health Services, Regulations and Coordination

UNICEF: United Nations Children's Fund

DFID: Department for International Development

SMART: Standardized Monitoring and Assessment of Relief and Transitions

WRA: Women of reproductive age

SD: Standard Deviation

OR: Odds Ratio

CI: Confidence Interval

### **Ethics approval and consent to participate.**

Before the study, the ethics approval was obtained from the Institutional Review Board (IRB), University of the Punjab, Lahore. All respondents who were 18 years or older, or their legal guardians if they were younger than 18, provided informed consent. We also obtained electronic approval from the Ministry of National Health Services and Coordination (MoNHSR & C) in Islamabad, Pakistan to use the data in June 2022.

**Consent for publication** Not applicable.

### **Availability of data and materials**

The data that support the findings of this study are available from the Ministry of National Health Services and Coordination (MoNHSR & C), Islamabad Pakistan but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Ministry of National Health Services and Coordination (MoNHSR & C).

### **Competing interests**

The authors declare no competing interests.

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### **Authors' contributions**

HAS: conceptualization, data collection form development, data collection, data analysis and writing the first draft and finalization; NAC: Supervision and review.

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### **References**

1. Roser H. Obesity. Our World in Data; 2017. Available from: (link unavailable) (Accessed June 22, 2022)
2. GBD 2017 Collaborators. Global Burden of Disease Study 2017. Seattle, United States: Institute for Health Metrics and Evaluation; 2018.
3. Kahan LG, Mehrzad R. Environmental factors related to the obesity epidemic. In: Obesity. Elsevier; 2020:117-139.

4. Ng M, Fleming T, Thomson B, et al. Global, regional and national prevalence of overweight and obesity in children and adults 1980-2013: A systematic analysis. *Lancet*. 2014;384(9945):766781. doi: 10.1016/S0140-6736(14)60460-8.
5. Sodjinou R, Agueh V, Fayomi B. Obesity and cardio-metabolic risk factors in urban adults of Benin: relationship with socio-economic status, urbanization, and lifestyle patterns. *BMC Public Health*. 2008; 8:84. doi: 10.1186/1471-2458-8-84.
6. GBD 2015 Obesity Collaborators. Global Burden of Disease Study 2015 (GBD 2015) Obesity and Overweight Prevalence 1980-2015. Seattle, United States: Institute for Health Metrics and Evaluation; 2017.
7. GBD 2015 Obesity Collaborators. Global Burden of Disease Study 2015 (GBD 2015) Obesity and Overweight Prevalence 1980-2015. *Metabolism*. 2018; 92:6-10. doi: 10.1016/j.metabol.2018.09.005. Epub 2018 Sep 22.
8. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, Mullany EC, Biryukov S, Abbafati C, Abera SF, Abraham JP. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2014;384(9945):766-81. doi: 10.1016/S0140-6736(14)60460-8.
9. Lovejoy JC. The influence of sex hormones on obesity across the female life span. *J Women's Health*. 1998;7(10):1247-1256.
10. Kanter R, Caballero B. Global gender disparities in obesity: a review. *Adv Nutr*. 2012;3(4):491498. doi: 10.3945/an112.002063.
11. Guthold R, Stevens GA, Riley LM, Bull FC. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1·9 million participants. *Lancet Glob Health*. 2018;6(10): e1077-e1086. doi: 10.1016/S2214-109X(18)30357-7.
12. Cresswell JA, Campbell OM, De Silva MJ, Filippi V. Effect of maternal obesity on neonatal death in sub-Saharan Africa: multivariable analysis of 27 national datasets. *Lancet*. 2012;380(9842):1325-1330. doi: 10.1016/S0140-6736(12)60867-6.
13. Deshmukh VL, Jadhav M, Yelikar K. Impact of high BMI on pregnancy: maternal and fetal outcome. *J Obstet Gynaecol India*. 2016;66(2):192-197.
14. Patel A, Prakash AA, Das PK, Gupta S, Pusdekar YV, Hibberd PL. Maternal anemia and underweight as determinants of pregnancy outcomes: a cohort study in eastern rural Maharashtra, India. *BMJ Open*. 2018;8(7): e021623. doi: 10.1136/bmjopen-2018-021623.
15. Bhavadharini B, Anjana RM, Deepa M, Jayashree G, Nrutya S, Shobana M, et al. Gestational weight gain and pregnancy outcomes in relation to body mass index in Asian Indian women. *Indian J Endocrinol Metab*. 2017;21(4):588-593.
16. World Health Organization. Noncommunicable Diseases Country Profiles 2019. Geneva: WHO; 2020. (link unavailable) (accessed June 01, 2024).
17. Tanzil S, Jamali T. Obesity, An Emerging Epidemic in Pakistan-A Review of evidence. *Research Gate*. 2016:3.
18. National Institute of Health, Pakistan. National Nutritional Survey 2018: Women of Reproductive Age (15-49 years). Islamabad: NIH; 2018
19. Asif M, Aslam M, Altaf S, Atif S, Majid A. Prevalence and sociodemographic factors of overweight and obesity among Pakistani adults. *Journal of obesity & metabolic syndrome*. 2020 Mar 3;29(1):58.
20. Shah SM, Nanani D, Rahbar MH, Rahim M, Nowshad G. Assessing obesity and overweight in a high mountain Pakistani population. *Tropical Medicine and International Health*. 2004;9(4):526532.

21. Zheng L, Deng F, Wang H, Yang B, Qu M, Yang P. Prevalence and Influencing Factors of Overweight and Obesity among Adult Residents of Western China: A Cross-Sectional Study. *International Journal of Chronic Diseases*. 2021;2021(1):9919443.
22. Al Kibria GM, Swasey K, Hasan MZ, Sharmeen A, Day B. Prevalence and factors associated with underweight, overweight and obesity among women of reproductive age in India. *Global health research and policy*. 2019 Dec; 4:1-2.
23. Abrha S, Shiferaw S, Ahmed KY. Overweight and obesity and its sociodemographic correlates among urban Ethiopian women: evidence from the 2011 EDHS. *BMC Public Health*. 2016 Jul 12; 16:636. DOI: 10.1186/s12889-016-3315-3.
24. Uthman OA. Patterns, distribution, and determinants of under- and overnutrition among women in Nigeria: A population-based analysis. *Journal of Public Health*. 2009;17(3):289-299.
25. Asfaw HA, Gebrehiwot EM, Shiferaw S. Effect of shiftwork on hypertension among factory workers in Ethiopia. *American Journal of Clinical and Experimental Medicine*. 2015;3(4):142-8.
26. Wu Y, Huxley R, Li M, Ma J. The growing burden of overweight and obesity in contemporary China. *CVD Prevention and Control*. 2009;4(1):19-26.
27. Neuman M, Finlay JE, Davey Smith G, Subramanian SV. The poor stay thinner: stable socioeconomic gradients in BMI among women in lower- and middle-income countries. *American Journal of Clinical Nutrition*. 2011;94(5):1348-57. DOI: 10.3945/ajcn.111.018127.
28. Birhane T, et al. Urban food insecurity in the context of high food prices: a community-based cross-sectional study in Addis Ababa, Ethiopia. *BMC Public Health*. 2014; 14:680.
29. Abdhahah KZ, Jean CF, Rhoun O. Overweight and obesity in urban Africa: A problem of the rich or the poor? *BMC Public Health*. 2009; 9:465.
30. Roskam AJR, Kunst AE, Van Oyen H, Demarest S, Klumbiene J, Regidor E, Helmert U, Jusot F, Dzurova D, Mackenbach JP. A comparative appraisal of educational inequalities in overweight and obesity among adults in 19 European countries. *International Journal of Epidemiology*. 2010;39(2):392-404.
31. McLaren L. Socioeconomic status and obesity. *Epidemiologic Reviews*. 2007; 29:29-48.
32. Bhurosy T, Jeewon R. Overweight and obesity epidemic in developing countries: a problem with diet, physical activity, or socioeconomic status? *The Scientific World Journal*. 2014;2014(1):964236.
33. Lear SA, Teo K, Gasevic D, Zhang X, Poirier PP, Rangarajan S, Seron P, Kelishadi R, Tamil AM, Kruger A, Iqbal R. The association between ownership of common household devices and obesity and diabetes in high-, middle- and low-income countries. *Cmaj*. 2014 Mar 4;186(4):25866.
34. Sartorius B, Veerman LJ, Manyema M, Chola L, Hofman K. Determinants of obesity and associated population attributability, South Africa: Empirical evidence from a national panel survey, 2008-2012. *PLoS One*. 2015 Jun 10;10(6): e0130218.
35. Yibeltal T, Charles T, Uriyoan C. The rising overweight-obesity and its socio-demographic correlates in Addis Ababa, Ethiopia, 2000-2011.
36. Bhavadharini B, Anjana RM, Deepa M, Jayashree G, Nrutya S, Shobana M, Malanda B, Kayal A, Belton A, Joseph K, Rekha K. Gestational weight gain and pregnancy outcomes in relation to body mass index in Asian Indian women. *Indian Journal of Endocrinology and Metabolism*. 2017 Jul 1;21(4):588-93.
37. Vorster HH, Venter CS, Wissing MP, Margetts BM. The nutrition and health transition in the Northwest Province of South Africa: a review of the THUSA (Transition and Health during Urbanisation of South Africans) study. *Public health nutrition*. 2005 Aug;8(5):480-90.
38. Ersoy C, Imamoglu S. Comparison of the obesity risk and related factors in employed and unemployed (housewife) premenopausal urban women. *Diabetes research and clinical practice*. 2006 May 1;72(2):190-6.

39. Navadeh S, Sajadi L, Mirzazadeh A, Asgari F, Haghazali M. Housewives' obesity determinant factors in Iran; national survey-stepwise approach to surveillance. *Iranian journal of public health*. 2011;40(2):87.
40. Mukora-Mutseyekwa F, Zeeb H, Nengomasha L, Kofi Adjei N. Trends in prevalence and related risk factors of overweight and obesity among women of reproductive age in Zimbabwe, 2005–2015. *International Journal of Environmental Research and Public Health*. 2019 Aug;16(15):2758.
41. Balarajan Y, Villamor E. Nationally representative surveys show recent increases in the prevalence of overweight and obesity among women of reproductive age in Bangladesh, Nepal, and India. *The journal of nutrition*. 2009 Nov 1;139(11):2139-44.