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Geographic and Socioeconomic Disparities in Nutritional Status of Women in Pakistan: Secondary Analysis from Pakistan National Nutrition Survey

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Abbreviations: AKU: Aga Khan University; BMI: Body Mass Index; HWQ: Household Wealth Quintiles; NNS: National Nutrition Survey; PDHS: Pakistan Demographic and Health Survey; RAF; Research and Advocacy Fund; SEP: Socioeconomic Position.

Abstract

Background: Pakistan is experiencing a rapid nutrition transition with a shift from underweight to overweight and obesity. This paper will examine the role of household socioeconomic position (SEP), community SEP and urbanicity on the nutritional status (underweight, overweight and obesity) of Pakistani women.

Methods: We analysed data on 34,391 women aged ≥20 years enrolled in 2011 National Nutritional Survey of Pakistan (NNS). The NNS is a nationally representative survey employing a multistage stratified cluster sampling design. We assessed household SEP through a wealth index constructed using items from household possessions, utilities and housing conditions. We assessed the relationship of urbanicity, household and community SEP with categories of body mass index (BMI) using multinomial logistic regression where normal BMI (18.6-22.5 kg/m2) was the reference category.

Results: Overall, 15% of women were underweight (BMI<18.5 kg/m^2), 14% were pre-overweight (BMI 23.00-24.9 kg/m^2), 22% were overweight (BMI 25.0-29.99 kg/m^2) and 12% were obese (BMI≥30.0 kg/m^2). Households with higher SEP were associated with increased levels of overweight-1 (aOR: 2.91; 95%CI: 2.41-3.50), overweight-2 (aOR: 4.15; 95%CI: 3.31-5.19) and obesity (aOR: 6.20; 95%CI: 4.92-7.81) among women. Women were more likely to be obese in major urban (aOR: 2.34; 95%CI: 2.02-2.71) and urban (aOR: 1.84; 95%CI: 1.62-2.09) areas compared to rural areas. At the community level, communities in rural areas were more likely to have higher levels of underweight,

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while communities in urban areas were more likely to have higher levels of obesity. Furthermore, the likelihood of underweight and overweight women coexisting within the same community was low in major urban (r=0.67), urban (r=0.55) and rural (r=0.54) areas.

Conclusions: In Pakistan, overweight and obesity among women is associated with urbanicity and household and community SEP. Women living in urban areas with high household and community SEP were associated with higher levels of overweight and obesity. Our findings suggest the importance of interventions targeting undernutrition in rural areas and overnutrition in urban areas.

Background

Maternal and child undernutrition is a major public health problem in developing countries, such as India, Pakistan and Bangladesh [1,2]. However, emerging evidence suggests the presence of a nutrition transition in developing countries; where the nutritional status of the population is shifting from underweight to overweight. At the regional and country level, the nutritional transition trends differ according to economic and dietary conditions [3,4]. Although undernutrition still contributes to poor health outcomes in the developing world, there is sufficient evidence that the rise in overweight and obesity is resulting in an increased burden of non-communicable diseases, such as diabetes and cardiovascular diseases [5].

In Pakistan, the overall proportion of underweight women has decreased from 25% to 13% over the past two decades; however simultaneously there has been a rise in the proportion of overweight women (22.5% to 34%). The 2011 National Nutrition Survey (NNS) also identified a major shift in the nutritional status of women, with 16% being underweight and 34% being overweight and obese [6]. Similar trends have been reported in the 2013 Pakistan Demographic and Health Survey (PDHS) [7]. However, there is limited data on the reasons for this nutrition transition among Pakistani women at the national level. Other studies have postulated the overall economic development (improved employment opportunities and higher incomes) as the factor leading to changes in lifestyle and dietary habits [8].

Regardless of the economic growth in Pakistan, there has been an increase in economic disparity at the population level [9-11]. The economic opportunities among lower socioeconomic segments of the population remain inequitable. This inequity in economic opportunities along with inflation limits the population's ability to access quality food in adequate quantity. According to the World Health Organization (WHO), 60% of Pakistanis live below the poverty line (< $2 per day), while another 21% lives on less than $1.25 per day [12].

Over the past decades, the population size of urban Pakistan has grown substantially [13]. The rise is linked to urbanization, which can have an impact on population health. Research has linked urbanization with improvements in access to healthcare, clean water, sanitation, education, social services and economic opportunities. These improvements have also led to an altering of the dietary and physical activity patterns with the population becoming more sedentary and experiencing a higher emergence of noncommunicable diseases and obesity [14-17].

We were not able to assess urbanicity on a continuum scale [14,16]. However, we used population size and the Federal Bureau of Statistics definition to classify urbanicity into major urban, urban and rural areas. We also did not have access to community level variables to characterize communities. For future studies, we recommend collecting community level variables to enable the assessment of community level factors affecting health and nutrition. However, the impact of urbanization on population health in Pakistan remains largely theoretical due to the limited evidence available. Therefore, we conducted a secondary analysis of the 2011 NNS to examine the association of household Socioeconomic Position (SEP), community SEP, and urbanization with the nutritional status of Pakistani women.

Methods

Data source, study setting and population

Our study used the data subset of the 2011 NNS [12]. The NNS is a large cross-sectional survey that collected data on the nutritional status and health indicators of women, children and older adults (≥ 50 years old) across Pakistan. The survey was administered by trained lady health workers (LHWs) through face-to-face interviews. A structured questionnaire, semi-structured interviews and focus groups were used to capture a wide range of data on household characteristics, food security, maternal and child health and nutrition status. Stratified two-stage cluster sampling was used to select a representative sample size. This resulted in 27,963 households completing the survey. However, for our study, the study population was restricted to women (≥ 20 years old), which gave a final sample size of 34,391 women.

Main exposures and covariates

The main exposures of interest were household SEP and community SEP. Research suggests that questionnaires on income do not provide a good indication of the socioeconomic status in developing countries. However, the use of household assets and material possessions as indicators of the wealth index is widely used; it is validated in India [19,20]. The household wealth index is an indicator based on household possessions, utilities and construction [21]. Such scales have shown good validity and reliability in classifying households by their wealth in developing countries and provide a measure of income inequality in health status [19,20,22]. We performed a Principle Component Analysis (PCA) based on household possessions, utilities (water source, cooking fuel, electricity, gas) and housing conditions (roof, wall and floor construction materials). The household wealth index score was generated by combining the score for each asset with weight for each asset derived from the PCA. The wealth index does not have a direct interpretation, since it is a constructed composite measure. Therefore, the population was divided into quintiles of the wealth index, with the 1st quintile representing the lowest SEP (poorest households) and the 5th quintile representing the highest SEP (richest households).

The community wealth index was calculated by combining household wealth index scores. The communities were also divided into quintiles, with the 1st quintile representing the lowest SEP (poorest communities) and the 5th quintile representing the highest SEP (richest communities). Covariates included in the analysis were age, ethnicity, individual education, household education, occupation, urbanicity (major urban, urban and rural), and province of residence.

Outcome

The nutritional status of women was assessed through Body Mass Index (BMI). The World Health Organization (WHO) clas-

sification for Asian populations was used to categorize BMI into the following groups: <18.5 kg/m^2 (underweight), 18.5-22.9 kg/m^2 (normal weight), 23.0–24.9 kg/m^2 (pre-overweight), 25.0-27.5 kg/m^2 (overweight-1), 27.6-29.9 kg/m^2 (overweight-2) and ≥30 kg/m^2 (obese) [23].

Statistical analysis

We computed the proportion of underweight, normal weight, pre-overweight, overweight and obese women and applied sampling weights to account for unequal sampling probabilities and clustering during data analysis.

Multinomial logistic regression was used to assess the relationship between SEP and BMI, where the normal BMI was used as the reference. The association of BMI categories were further assessed across household wealth quintiles, community wealth quintiles, age, education, urbanicity, and occupation. Using the multinomial logistic regression, we calculated the adjusted odds ratios (aOR) with 95% confidence intervals. The interaction was assessed between household wealth, community wealth and urbanicity.

For BMI categories, multilevel multinomial logistic regression was used to assess the variance in nutritional status between communities, with a community level random effect. The random effects used were specific to underweight and overweight, allowing for different community level factors to affect each outcome category. If correlated, the random effects for underweight and overweight would demonstrate the extent to which underweight and overweight women coexist in communities. The normal BMI was used as the reference. All analyses were performed using SAS statistical software (version 9.3).

Results

Participant profile

From the 2011 NNS, a total of 34,391 adult women aged 20 years or older were included in the secondary data analysis. Majority of the women were housewives (90%) aged between 20-39 years (67%), from rural areas (67%), with no formal education (62%) (Table 1; Figure 1). Most of the women were from the province of Punjab (55%). Among the employed women, 3% were identified as unskilled labourers or farm workers. Only 1% of the women were highly educated with post-secondary education and worked in the services sector. Overall, 36% of women were normal weight, 15% were underweight, 14% were pre-overweight, 22% were overweight and 12% were obese.

Household SEP and underweight

A gradual decrease was observed in the proportion of underweight women across household wealth quintiles (HWQ) with 27% in the 1st HWQ (lowest SEP; poorest household) to 4% in the 5th quintile (highest SEP; richest household). After adjusting for covariates, women in the 1st HWQ were more likely to be underweight than those in the 3rd quintile (aOR: 0.73; 95%CI: 0.64-0.83) and the 5th quintile (aOR: 0.57; 95%CI: 0.48-0.68) (Table 2).

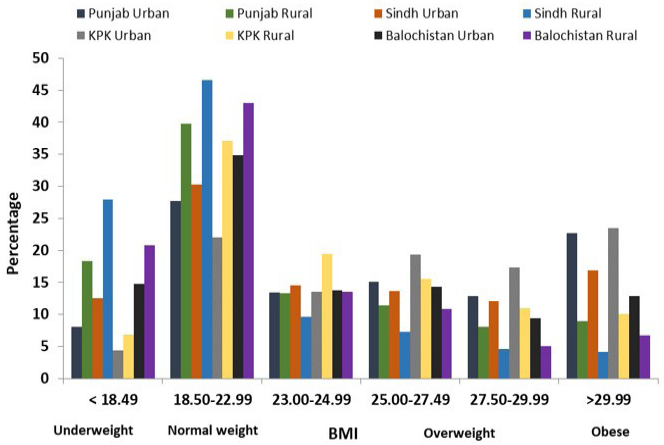

Figure 1: Distribution of BMI categories by province, urban and rural areas among Pakistani women.

Table 1: Distribution of BMI by participants' characteristics, National Nutritional Survey of Pakistan 2011.

	N		Underweight	Normal	Pre-overweight	Overweight		Obesity
		Overall	<18.5	18.5-22.9	23.0-24.9	25.0-27.5	27.5-29.9	≥30
		N (%; 95%CI)	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)
Total Sample	34391	-	1 5(15 -16)	36 (36 -37)	14 (14 -15)	13 (12 -13)	10 (9 -10)	12 (12 -13)
Urbanicity								
Major Urban	7028	20 (19 -20)	9 (8 -10)	27 (25 -28)	14 (13 -15)	15 (14 -16)	14 (13 -15)	22 (21 -24)
Urban	7507	13 (12 -13)	11 (10 -12)	32 (30 -33)	14 (13 -15)	15 (14 -16)	11 (11 -12)	17 (16 -18)
Rural	19856	67 (67 -68)	18 (17 -18)	40 (39 -41)	14 (13 -15)	12 (11 -12)	8 (8 -8)	8 (8 -9)
Province								
Punjab	16665	55 (54 -55)	15 (14 -16)	36 (35 -37)	13 (13 -14)	13 (12 -13)	10 (9 -10)	13 (13 -14)
Sindh	7480	22 (22 -23)	20 (19 -21)	38 (37 -40)	12 (11 -13)	11 (10 -11)	8 (8 -9)	11 (10 -12)
KPK	4150	13 (13 -14)	6 (5 -8)	35 (32 -37)	19 (16 -21)	16 (15 -18)	12 (11 -13)	12 (11 -14)
Balochistan	2483	4 (4 -5)	19 (17 -21)	41 (38 -43)	14 (12 -15)	12 (11 -13)	6 (5 -8)	8 (7 -10)
FATA	758	2 (2 -2)	2 (0 -5)	26 (20 -31)	21 (17 -26)	25 (21 -30)	15 (11 -19)	11 (7 -14)
AJK	1801	3 (2 -3)	19 (16 -22)	39 (37 -42)	16 (13 -18)	11 (10 -13)	8 (6 -9)	7 (5 -9)
Gilgit	1054	1 (1 -1)	16 (12 -20)	48 (45 -52)	16 (12 -19)	10 (8 -12)	6 (4 -8)	3 (2 -5)

Age (years)								
20- 29	12733	37 (36 -37)	19 (18 -19)	44 (43 -45)	14 (13 -15)	10 (10 -11)	7 (6 -7)	6 (6 -7)
30-39	10438	30 (29 -31)	13 (12 -13)	35 (34 -36)	14 (14 -15)	14 (13 -15)	10 (10 -11)	13 (13 -14)
40-49	4718	14 (13 -14)	11 (10 -12)	29 (27 -30)	13 (12 -14)	15 (14 -16)	13 (12 -14)	19 (18 -21)
50-59	3399	10 (10 -10)	11 (9 -12)	28 (27 -30)	13 (11 -14)	15 (14 -17)	13 (12 -14)	20 (18 -22)
60-69	2101	6 (6 -7)	16 (14 -18)	31 (28 -33)	15 (13 -16)	13 (11 -15)	11 (10 -13)	14 (12 -16)
70-79	719	2 (2 -2)	25 (21 -28)	32 (28 -35)	13 (10 -16)	12 (9 -14)	8 (5 -10)	11 (9 -14)
≥80	283	1 (1 -1)	33 (27 -39)	37 (30 -43)	12 (7 -18)	8 (4 -11)	6 (2 -9)	4 (2 -7)
Occupation								
Business/shop/landlord	82	0 (0 -0)	15(5 -24)	34 (21 -47)	12 (5 -19)	16 (7 -24)	10 (3 -18)	13 (5 -21)
Services (higher education)[1]	382	1 (1 -1)	9 (6 -13)	32 (26 -37)	15 (11 -20)	17 (13 -22)	13 (9 -18)	14 (10 -18)
Services (lower education)[2]	429	1 (1 -1)	16 (12 -20)	34 (29 -39)	16 (12 -20)	12 (9 -15)	9 (6 -13)	12 (9 -16)
Skilled manual workers	17	0 (0 -0)	19 (0 -39)	17 (0 -38)	34 (7 -60)	5 (0 -15)	16 (0 -33)	9 (0 -27)
Unskilled/Farm workers	832	3 (2 -3)	23 (20 -26)	48 (44 -52)	9 (7 -11)	8 (6 -10)	5 (4 -7)	6 (4 -8)
Housewife	30976	90 (90 -91)	14 (14 -15)	36 (35 -37)	14 (14 -15)	13 (13 -13)	10 (9 -10)	13 (12 -13)
Student/unemployed/retired	1283	4 (3 -4)	26 (23 -29)	38 (35 -42)	13 (11 -15)	10 (8 -11)	6 (4 -8)	6 (5 -8)
Non-manual	893	2 (2 -2)	13 (11 -16)	33 (29 -37)	15 (13 -18)	14 (12 -17)	11 (9 -13)	13 (10 -16)
Manual work	849	3 (2 -3)	23 (20 -26)	47 (44 -51)	10 (7 -12)	8 (6 -10)	5 (4 -7)	6 (4 -8)
Education (years)								
No formal schooling	20856	62 (61 -63)	17 (16 -17)	39 (38 -39)	13 (13 -14)	12 (12 -13)	9 (8 -9)	10 (10 -11)
Primary (1-5 years)	3723	11 (11 -12)	14 (12 -15)	36 (35 -38)	13 (12 -15)	12 (11 -14)	11 (10 -12)	13 (12 -15)
Secondary (6-10 years)	6180	18(17 -18)	12 (11 -13)	32 (30 -33)	16 (14 -17)	14 (13 -15)	10 (9 -11)	16 (15 -18)
College (11-12 years)	1735	5 (4 -5)	13 (11 -15)	31 (28 -34)	15 (13 -18)	13 (12 -15)	12 (10 -14)	16 (13 -18)
University (>12 years)	1897	5 (4 -5)	10 (8 -12)	32 (29 -34)	16 (14 -18)	15 (13 -17)	12 (10 -14)	15 (14 -17)
Household education (years)								
No formal schooling	7984	24 (23 -25)	21 (20 -22)	42 (40 -43)	13 (12 -14)	11 (10 -12)	7 (7 -8)	7 (6 -8)
Primary (1-5 years)	12091	36 (35 -37)	16 (15 -17)	40 (39 -41)	14 (13 -14)	12 (12 -13)	8 (8 -9)	10 (9 -11)
Secondary (6-10 years)	10682	30 (29 -31)	11 (10 -12)	32 (31 -33)	15 (14 -16)	14 (14 -15)	11 (11 -12)	16 (15 -17)
College (11-12 years)	2151	6 (5 -6)	9 (7 -10)	28 (26 -31)	14 (13 -16)	14 (13 -16)	13 (12 -15)	21 (18 -23)
University (>12 years)	1483	4 (3 -4)	6 (5 -8)	22 (19 -24)	16 (14 -19)	15 (12 -17)	16 (13 -18)	25 (23 -28)
Household wealth quintiles								
1st quintile (Poorest)	5910	18 (17 -19)	27 (26 -29)	47 (46 -48)	11 (10 -12)	7 (6 -8)	4 (3 -5)	4 (3 -4)
2nd quintile	6312	19 (19 -20)	17 (16 -18)	42 (40 -43)	16 (15 -18)	12 (11 -13)	7 (7 -8)	6 (5 -7)
3rd quintile	6745	20 (19 -21)	14 (13 -15)	39 (38 -40)	14 (13 -15)	14 (13 -15)	9 (8 -10)	10 (9 -11)
4th quintile	7238	21 (20 -21)	11 (11 -12)	31 (30 -33)	15 (14 -16)	15 (14 -16)	12 (11 -12)	16 (15 -17)
5th quintile (Richest)	8186	22 (21 -23)	7 (7 -8)	25 (24 -27)	15 (14 -16)	15 (14 -16)	15 (14 -16)	23 (21 -24)

1 ≥14 years of education, 2 < 14 years of education

Table 2: Multivariable model for association of household socioeconomic position and other participants' characteristics with categories of BMI among women, National Nutritional Survey of Pakistan 2011.

	Adjusted ORs(95% confidence interval)				
Covariates	**BMI <18.5**	**BMI 23 -24.99**	**BMI 25.0 - 27.49**	**BMI 27.5 -29.9**	**BMI ≥ 30**
Wealth quintile					
1st quintile (Poorest)	1.00	1.00	1.00	1.00	1.00
2nd quintile	0.76 (0.68 -0.85)	1.4 (1.21 -1.62)	1.51 (1.29 -1.77)	1.51 (1.24 -1.84)	1.64 (1.33 -2.03)
3rd quintile	0.73 (0.64 -0.83)	1.32 (1.14 1.53)	1.93 (1.63 -2.28)	1.99 (1.65 -2.41)	2.62 (2.12 -3.24)
4th quintile	0.72 (0.62 -0.83)	1.62 (1.37 -1.92)	2.49 (2.09 -2.97)	2.99 (2.44 -3.68)	4.23 (3.38 -5.29)
5th quintile (Richest)	0.57 (0.48 -0.68)	1.84 (1.53 -2.2)	2.91(2.41 -3.5)	4.15 (3.31 -5.19)	6.2 (4.92 -7.81)
Urbanicity					
Major urban	0.84 (0.73 -0.97)	1.18 (1.03 -1.36)	1.47 (1.27 -1.69)	1.56 (1.33 -1.83)	2.34 (2.02 -2.71)
Urban	0.85 (0.75 -0.96)	1.13 (1.02 -1.26)	1.37 (1.23 -1.53)	1.4 (1.23 -1.59)	1.84 (1.62 -2.09)
Rural	1.00	1.00	1.00	1.00	1.00
Household education (years)					
No formal schooling	1.00	1.00	1.00	1.00	1.00
Primary (1-5 years)	0.87 (0.78 -0.96)	1.08 (0.97 -1.2)	1.05 (0.93 -1.19)	1 (0.87 -1.14)	1.11 (0.96 -1.28)
Secondary (6-10 years)	0.83 (0.74 -0.94)	1.34 (1.18 -1.53)	1.24 (1.09 -1.4)	1.27 (1.1 -1.48)	1.49 (1.28 -1.74)
College (11-12 years)	0.77 (0.62 -0.97)	1.36 (1.12 -1.65)	1.25 (1.01 -1.55)	1.38 (1.1 -1.73)	1.72 (1.35 -2.19)
University (>12 years)	0.75 (0.56 -1.01)	1.91 (1.51 -2.41)	1.47 (1.14 -1.89)	1.76 (1.37 -2.26)	2.33 (1.81 -2.99)
Province					
AJK	1.34 (1.09 -1.65)	1.09 (0.84 -1.41)	0.89 (0.69 -1.16)	0.84 (0.62 -1.15)	0.7 (0.5 -0.99)
Balochistan	1.09 (0.89 -1.34)	0.98 (0.77 -1.24)	1.06 (0.85 -1.32)	0.77 (0.56 -1.07)	0.9 (0.68 -1.2)
FATA	0.27 (0.11 -0.67)	2.25 (1.49 -3.4)	3.83(2.51 -5.85)	3.47 (2.07 -5.83)	2.79 (1.59 -4.87)
Gilgit	1.14 (0.77 -1.68)	0.93 (0.62 -1.38)	0.67 (0.45 -1.01)	0.6 (0.39 -0.93)	0.28 (0.16 -0.48)
KPK	0.56 (0.42 -0.73)	1.26 (1 -1.58)	1.26 (0.98 -1.6)	1.26 (0.99 -1.62)	1.01 (0.78 -1.31)
Sindh	1.27 (1.09 -1.47)	0.93 (0.79 -1.09)	0.79 (0.67 -0.93)	0.8 (0.68 -0.95)	0.72 (0.59 -0.88)
Punjab	1.00	1.00	1.00	1.00	1.00
Occupation					
Non-manual	1.32 (0.93 -1.86)	1.27 (0.89 -1.82)	1.28 (0.89 -1.85)	1.22 (0.79 -1.88)	0.96 (0.61 -1.5)
Manual work	1.00	1.00	1.00	1.00	1.00
Housewife	1.06 (0.87 -1.3)	1.42 (1.09 -1.84)	1.38 (1.04 -1.82)	1.48 (1.07 -2.05)	1.41 (1 -2.01)
Student/Retired/Unemployed	1.9 (1.45 -2.49)	1.08 (0.76 -1.53)	0.94 (0.65 -1.36)	0.82 (0.52 -1.29)	0.72 (0.45 -1.14)
Underage/Not reported	1.28 (0.87 -1.89)	0.86 (0.5 -1.49)	1.11 (0.71 -1.73)	0.85 (0.5 -1.42)	0.88 (0.48 -1.59)

(N= 34391); Reference: BMI= 18.5-22.9, N=12380

Household SEP, overweight and obesity

An increase in overweight and obese women was observed with rising HWQ, with the largest proportion of overweight (30%) and obese (23%) women found in the 5th quintile (highest SEP; richest household) (Table 1). Furthermore, the multivariable model demonstrated an increasing gradient in adjusted odds ratios (aOR) for overweight and obesity across wealth quintiles with aORs ranging from 1.51 (2nd quintile) to 2.91 (5th quintile) for overweight-1, 1.51 (2nd quintile) to 4.15 (5th quintile) for overweight-2 and 1.64 (2nd quintile) to 6.20 (5th quintile) for obesity (Table 2).

Community SEP, urbanicity, underweight and overweight

Overall, women living in rural areas were more likely to be underweight than those living in major urban (aOR: 0.84; 96%CI: 0.73-0.97) and urban areas (aOR: 0.85; 95%CI: 0.75-0.96). The proportion of overweight and obesity was significantly different across urbanicity, with the largest amount of obese women living in major urban areas (aOR: 2.34; 95%CI: 2.02-2.71) (Table 2, Figure 1).

Table 3: Multivariable models for the interaction between household socioeconomic position and urbanicity, and the interaction of household socioeconomic position for association with categories of BMI among women, National Nutritional Survey of Pakistan 2011.

Covariates	Adjusted ORs(95% confidence interval)			
	BMI <18.5	BMI 23 -24.99	BMI 25.0 -29.9	BMI ≥ 30
Household wealth quintile (HWQ) and urbanicity				
Major Urban				
1st quintile (Poorest)	1.19 (0.56 -2.5)	0.84 (0.37 -1.91)	0.61 (0.15 -2.54)	0.61 (0.15 -2.54)
2nd quintile	0.73 (0.44 -1.22)	1.73 (1.05 -2.84)	2.01 (1.21 -3.33)	2.69 (1.39 -5.23)
3rd quintile	0.48 (0.36 -0.63)	1.13 (0.83 -1.54)	1.9 5(1.5 -2.53)	2.86 (2.01 -4.07)
4th quintile	0.6 1(0.47 -0.8)	1.82 (1.39 -2.39)	3.21 (2.51 -4.11)	5.6 (4.08 -7.69)
5th quintile (Richest)	0.5 (0.37 -0.68)	1.84 (1.41 -2.39)	3.38 (2.65 -4.29)	**6.87 (5.09 -9.29)**
Urban				
1st quintile (Poorest)	0.88 (0.62 -1.26)	1.27 (0.87 -1.86)	1.37 (1 -1.88)	2.18 (1.25 -3.8)
2nd quintile	0.7 (0.54 -0.91)	1.34 (1.03 -1.73)	2.08 (1.61 -2.68)	2.54 (1.79 -3.6)
3rd quintile	0.65 (0.51 -0.83)	1.49 (1.18 -1.9)	2.09 (1.68 -2.6)	3.85 (2.81 -5.28)
4th quintile	0.52 (0.41 -0.66)	1.58 (1.24 -2)	2.64 (2.11 -3.32)	4.34 (3.27 -5.75)
5th quintile (Richest)	0.49 (0.36 -0.65)	1.7 (1.33 -2.18)	3.16 (2.5 -3.99)	**5.27 (3.92 -7.08)**
Rural				
1st quintile (Poorest)	1.00	1.00	1.00	1.00
2nd quintile	0.75 (0.67 -0.85)	1.36 (1.18 -1.58)	1.35 (1.16 -1.57)	1.44 (1.15 -1.82)
3rd quintile	0.73 (0.63 -0.85)	1.27 (1.08 -1.49)	1.69 (1.44 -1.98)	2.07 (1.62 -2.63)
4th quintile	0.72 (0.6 -0.87)	1.47 (1.21 -1.79)	2.13 (1.76 -2.58)	3.06 (2.35 -4)
5th quintile (Richest)	0.52 (0.41 -0.67)	1.76 (1.41 -2.21)	2.95 (2.37 -3.67)	**4.63 (3.48 -6.17)**
Community wealth quintile				
1st quintile (Poorest)	1.00	1.00	1.00	1.00
2nd quintile	1 (0.87 -1.14)	1.16 (0.98 -1.36)	1.33 (1.14 -1.56)	1.46 (1.14 -1.87)
3rd quintile	1.07 (0.92 -1.23)	1.11 (0.94 -1.32)	1.45 (1.22 -1.71)	1.64 (1.28 -2.11)
4th quintile	1.0 4(0.85 -1.27)	1.25 (1.02 -1.52)	1.56 (1.28 -1.9)	2.19 (1.67 -2.88)
5th quintile (Richest)	1.03 (0.81 -1.31)	1.27 (1 -1.61)	1.76 (1.41 -2.18)	2.87(2.15 -3.84)

(N= 34391); Reference: BMI= 18.5-22.9, N=12380

The multivariable model for HWQ and urbanicity demonstrated a gradual increase in overweight and obesity with increasing wealth quintiles in rural and urban areas. The interaction of HWQ and urbanicity for obesity was most evident in the 5th quintile, with women living in major urban areas (aOR: 6.87; 95%CI 5.09-9.29) being more likely to be obese than those in urban areas (aOR: 5.27; 95%CI3.92-7.08) and rural areas (aOR: 4.63; 95%CI 3.48-6.17) (Table 3).

When assessing the interaction between community wealth quintiles and nutritional status, there was an increase of the effect estimates (aORs) for obesity across community wealth (Table 3). The difference in underweight across community wealth quintiles was not statistically significant.

A trend was observed among household education levels and obesity. Households with higher levels of education were more likely to have overweight and obese women. Moreover, the likelihood of overweight and obesity among women increased consistently with the attainment of higher education; overweight-1 (aOR: 1.47; 95%CI 1.14-1.89), overweight-2 (aOR: 1.76; 95%CI 1.37-2.26) and obesity (aOR: 2.33; 95%CI 1.81-2.99) (Table 2).

Province of residence, underweight and overweight

Among the provinces of Pakistan, the largest proportions of underweight women were in rural Sindh (20%) and rural Balochistan (19%) (Figure1). Alternatively, women living in urban KPK (23%) and urban Punjab (23%) were found to the most overweight and obese women. In comparison to Punjab, women living in AJK (aOR: 1.34; 95%CI: 1.09-1.65) and Sindh (aOR: 1.27; 95%CI 1.09- 1.47) were more likely to be underweight (Table 2). Additionally, women in FATA (aOR: 0.27; 95%CI: 0.11-0.67) were less likely to be underweight compared to those in Punjab. As for women in Gilgit, there were less likely to be overweight (aOR: 0.60; 95%CI: 0.39-0.93) and obese (aOR: 0.28; 95%CI: 0.16-0.48) compared to women in Punjab.

Co-existence of underweight and obesity at community level

We evaluated the correlation of underweight and overweight parameters to assess whether underweight and overweight women coexist at the community level. The moderate negative association in major urban (r=0.67), urban (r=0.55) and rural (r=0.54) communities suggest that the likelihood of underweight and overweight women coexisting within the same community is low. (Figure 2).

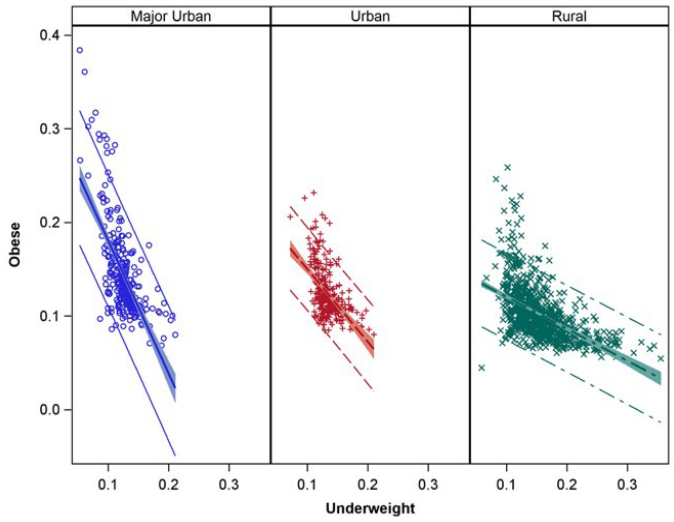

Figure 2: Scatterplot of the community specific residuals for underweight and obesity in major urban[1], urban[2] and rural[3] areas of Pakistan.

1. Correlation of underweight and overweight parameters in major urban areas: r = 0.67
2. Correlation of underweight and overweight parameters in urban areas: r = 0.55
3. Correlation of underweight and overweight parameters in rural areas: r = 0.54

Discussion

According to the 2011 NNS, the prevalence of underweight (15%) is lower than overweight and obesity combined (35%) among Pakistani women. Our findings suggest a noticeable difference in the level of underweight, overweight and obesity with household and community SEP and urbanicity. Underweight women were mainly found in poor rural areas, while overweight and obese women were mainly in rich urban areas. Furthermore, the likelihood of being overweight or obese increased drastically for women living in wealthier communities located in urban areas. We also found that underweight, overweight, and obesity did not co-exist within the same community. Overall, underweight women were more likely to be among the poorest, rural dwelling with the fewest years of formal schooling. This emphasizes that despite a decrease in the prevalence of underweight women, targeted nutrition interventions are still essential. Alternatively, an increasing trend in overweight and obesity was associated with an increase in SEP, urbanization and education. Further analyses on community characteristics would be important in developing and delivering interventions that are relevant to local needs.

Similar to our findings, research conducted in other South Asian countries has found a comparable distribution of underweight, overweight and obesity across SEP. However, the overall prevalence of overweight and obesity in Bangladesh (2007: 10%,1.7%; 2011: 17%,2.9%), India (2006: 9.8%,2.9%) and Nepal (2011: 11.2%,2.2%) is lower than Pakistan (2011: 22%, 12%). [25-27]. In India, there has been an increase in overweight and obesity among communities with higher SEP. However, about 50% of Indian women are still underweight, with the majority living in communities with lower SEP [28]. Similar findings have been reported from Bangladesh [29,30]. This suggests that Pakistan is at a relatively similar stage of nutrition transition as compared to its neighbouring countries [11,31,32].

Women with higher education were associated with increased risk of overweight and obesity. In most developing countries, such as Pakistan, India and Bangladesh, a positive association between education and BMI has been reported [28,30,32]. However, in contrast to our findings, a local study from the Khairpur district showed that education was associated with lower levels of obesity [11]. The situation observed in Khairpur is identical to the advanced stage of nutrition transition seen in Brazil, where higher levels of education are associated with lower levels of obesity [33,34]. However, further research is needed to assess if higher levels of education and higher SEP have an association with obesity in Pakistan. Additional factors that may have increased the proportion of overweight women are sedentary jobs, availability of household help and the perception that a plump body size is associated with higher SEP [35]. Households with higher SEP are associated with higher consumption of meats, fats and fast foods, especially in urban areas [36,37]. At later stages of nutrition transition, commonly seen in developed countries, BMI is inversely proportional to educational achievement since more research is needed.

The risk of overweight and obesity increased with urbanicity even after controlling for SEP and education. These findings are consistent with other research conducted in developing countries, including India and Bangladesh [28,38-40]. Literature has also identified cities as promoting overweight and obesity through their obesogenic environment with increased availability of fast food and other restaurants and increasing norms of eating out, mechanized transportation, sedentary jobs and low physical activity [41-43]. Lack of parks, air pollution, actual and perceived safety, violence and political instability and cultural and religious norms may also constraint physical activity in an overall sedentary environment [44,45]. Data on the influence of neighbourhood environments, including food and physical activity, is needed from Pakistan and other developing countries to understand role of urban environment on overweight and obesity. Such data may provide useful evidence for urban planning and shaping urban environment to tackle the obesity problem.

Conclusions

Our results show that the overweight and obesity are significant public health problem in Pakistan, especially in urban areas. Underweight still persists among the rural poor, especially in the province of Sindh. These findings emphasize the importance of interventions targeting undernutrition in rural areas and overnutrition in urban areas. Furthermore, our study has showed that underweight and overweight do not exist in the same communities, thus providing avenues for targeted interventions according to local needs at the community level. The high levels of overweight and obesity in major urban areas

highlights the need for urgent action to lower the increasing burden of chronic diseases, such as diabetes and cardiovascular disease. Also, further analyses on geospatial distribution of underweight, overweight and communities' characteristics are required to improve the development and delivery of nutritional interventions relevant to the local need.

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