RESEARCH ARTICLE

Burden and predictors of undernourishment among married women of reproductive age: A cross-sectional study in Dadu and Jacobabad districts of the Province Sindh, Pakistan

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Abstract

Objective: To assess the nourishment level of married women of reproductive age in a two rural setting.

Method: The cross-sectional study was based on secondary data of the Impact Assessment Survey 2019, which was conducted by the People's Primary Health Care Initiative from January to May, 2019, in Dadu and Jacobabad districts of the province of Sindh, Pakistan. Nutritional status of married women of reproductive age was analysed using mid-upper arm circumference; <23cm being indicative of under-nourishment, and <21cm of severe under-nourishment. Predicting factors were identified using multivariate logistic regression. Data was analysed using STATA 15.

Results: Of 10,388 subjects, 5,138(49.5%) were from Dadu and 5,250(50.5%) from Jacobabad. The overall mean age was 32.9±8.1 with 4,739(45.6%) aged 25-35 years. Overall, 2,336(22.5%) subjects were undernourished and 609(5.9%) were severely undernourished. Age, education, socio-economic status and parity were significant predictors of the nourishment status ($p<0.05$), while location and health facility type were significant predictors of severe undernourishment ($p<0.05$), but were not related to undernourishment ($p>0.05$).

Conclusion: Overall nutrition status of the married women of reproductive age in the two rural districts of Sindh was less than satisfactory.

Keywords: Undernourishment, Underweight, Mid-upper arm circumference, Women of reproductive age, Pakistan.

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Introduction

While overweight and obesity are prevailing five times higher in high-income countries (HIC) compared to low- and middle-income countries (LMICs), underweight persists in the LMICs almost 10 times higher compared to the HICs.[1] The gender differences of underweight indicate that more women than men are underweight; and in 2019, approximately 40% of the girls and 12% of adult women age >18 years were underweight in the LMICs.[1] All of these numbers point to the high prevalence of underweight in LMICs and women, particularly those of childbearing age, are more vulnerable. Although malnutrition is evident over the life course, the causes of malnutrition span generations, and, therefore, it is important to improve the nutritional status of women of reproductive age (WRA) 15-49 years.

Pakistan's progress in terms of maternal health and nutrition is substantially slower than the neighbouring countries.[2,3] Although the overall proportion of underweight (body mass index [BMI] <18.5kg/m^2) among WRA was 14.4% in 2018,[4] it has only decreased 10.6% (25% in 1993-94) in about two-and-a-half decades.[5] The prevalence of underweight is higher in rural areas (16%) compared to urban areas (12%), and the proportion is the highest in the Sindh province (22.6%) compared to any other province in Pakistan.[4] Women's education, early marriages, high rates of fertility, shorter birth intervals, poor access to clean water and sanitation, and food uncertainty are the factors interacting with maternal nutrition.[5] However, prevalence is the highest among the poorest, uneducated, and rural women.[5] A study based on a 2011 National Nutrition Survey of Pakistan found that women in wealthy households were taller and heavier than women from poor households.[6]

While BMI has been used as a measure of underweight in all earlier studies, the emerging body of evidence has suggested concerns over accurately measuring body weight in resource-constrained settings, which, in turn, could increase the risk of under- or over-estimation of BMI.[7,8] Thus, more recently, mid-upper arm circumference (MUAC) has been identified as one of the reliable markers for assessing under-nutrition among WRA in resource-poor countries.[9,10] The current study was planned to assess the burden and predictors of undernourishment/underweight and severe undernourishment/underweight using MUAC among married WRA (MWRA), and to analyse the health situation of the catchment area population at primary health care facilities (PHCFs) in rural settings.

Subjects and Methods

The cross-sectional study was based on secondary data of

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the Impact Assessment Survey (IAS) 2019, which was conducted by the People's Primary Healthcare Initiative (PPHI) from January to May, 2019, in Dadu and Jacobabad districts of the province of Sindh, Pakistan. PPHI is a public-private partnership programme of the government of Sindh, initiated in 2007 to revitalise the delivery of health services in the rural and under-served areas of the province, and is currently managing 1,238 health facilities in 23 districts of rural Sindh.

The IAS followed a three-stage random sampling technique. Initially, all PHCFs, Including basic health units (BHUs) and maternal and child health centres (MCHCs)) operated by either PPHI or the government, were identified in the two districts. The second stage involved line-listing and systematic random selection of households in each PHCF catchment area, and the third stage involved the selection of all WRAs from those households. The IAS sample size was calculated based on the national neonatal death which is 55 per 1,000 live births[11] and it was assumed to be the same for all catchment populations. Anticipating a 5% decrease in neonatal mortality in PPHI-operated PHCFs with a power of at least 90% at a 5% significance level, a sample size of 1002 households per PHCF was calculated after applying the design effect of 1.2 and 20% non-response rate. A total of 10 PHCFs from each district were selected; 5 each operated by the PPHI and the government.

The original survey selected a total of 12,739 MWRA from the district Dadu, which is located in the east of Sindh, with a population of 1.5 million, and the district Jacobabad, which is located in the north of Sindh, with a population of one million. Women who were pregnant at the time of the survey were excluded.

Data was collected after taking informed verbal consent from each participant, and IAS was collected during face-to-face interviews using a structured tablet-based questionnaire. The survey questionnaire included a range of topics on women's general health, sexual and reproductive health, including information on socio-demographic characteristics of the women and their husbands, and anthropometric data. The primary variable of interest was underweight/undernourishment which was evaluated based on the nutritional status of MWRA using MUAC. MUAC is the circumference of the left upper arm, measured at the mid-point between the tip of the shoulder and the tip of the elbow, which is olecranon process and the acromium. In the current study, a cut-off value of <23cm for under-nourishment and <21cm for severe under-nourishment. Field workers were given classroom and on-field training for data collection and gathering anthropometric measurements. During these measurements, the women were asked to stand in a comfortable position looking straight ahead with shoulders in a normal position. MUAC tapes were used by the field workers and they asked the participant to bend the left arm, identified and marked the mid-point using a pen, wrapped the MUAC tape with the arm hanging down straight, and measured the circumference. The measurement was taken thrice and was always marked to the nearest 1mm. The final value was a mean of three measurements.

The explanatory variables included the participant's age, education, occupation, socio-economic status (SES), parity, type of health facility (THF) in the catchment area, and the district where the participant was residing. The study categorised age as <25 years, 25-35 years, and >35 years; education as no education, primary or higher education; occupation as working, and not working; parity as never given birth, had given childbirth <3 times, and three or more times; SES was constructed using principal component analysis on assets-ownership, including land and livestock, with a range of socio-economic factors, including household construction, household items, utilities, source of drinking water and sanitation facilities, etc. and categorized as five wealth quintiles, starting from the poorest to the richest; THF in the catchment area either run by PPHI or the government; and district the participants were residing in i.e. Dadu and Jacobabad.

Data was analysed using STATA 15. Descriptive statistics were carried out using frequencies and percentages for categorical variables, and mean and standard deviation for continuous variables. Chi-square test was used to detect significance of association between nutritional status and background characteristics for categorical variables, and independent sample t-test for continuous variables. Since the study treated under-nourishment and severe under-nourishment as a binary variable, bivariate and multivariable analyses were performed using logistic regression, and two separate models were prepared for undernourished/underweight (MUAC <23 cm), and severe undernourished/underweight (MUAC <21 cm). Variables with $p<0.25$ in the bivariate model were considered for adjustment in the multivariable model using the hierarchical elimination method, and only variables with $p<0.05$ were retained within the final model. Odds ratio (OR), adjusted odds ratio (AOR), and their 95% confidence intervals (CIs) were computed with statistical significance determined at $p<0.05$. Model performance was evaluated by estimating model discrimination (C-statistic) and calibration.

Table-1: Baseline characteristics of married women of reproductive age (MWRA) and distribution of the nutritional status in districts Dadu and Jacobabad.

Characteristics	Total n=10388 (%)	Nourished (MUAC > 23 cm) n=8052 (%)	Undernourished (MUAC > 23 cm) n=2336 (%)	*p-value*[1]	Nourished (MUAC > 21 cm) n=9779 (%)	Severely Undernourished (MUAC > 21 cm) n=609 (%)	*p-value*[1]
Age (years)							
<25 Years	1761 (17.0)	1118 (63.5)	643 (36.5)	<0.001	1603 (91.0)	158 (9.0)	<0.001
25-35 Years	4739 (45.6)	3657 (77.2)	1082 (22.8)		4477 (94.5)	262 (5.5)	
>35 Years	3888 (37.4)	3277 (84.3)	611 (15.7)		3699 (95.1)	189 (4.9)	
Mean ± SD[2]	32.9 ± 8.1	33.7 ± 8.0	30.3 ± 8.1	<0.001	33.1 ± 8.1	30.9 ± 8.3	<0.001
Woman Education							
No education	8938 (86.6)	6812 (76.2)	2126 (23.8)	<0.001	8382 (93.8)	556 (6.2)	<0.001
Primary and higher (any)	1382 (13.4)	1194 (86.4)	188 (13.6)		1337 (96.7)	45 (3.3)	
Occupation							
Working	3622 (34.9)	2,723 (75.2)	899 (24.8)	<0.001	3450 (95.3)	172 (4.7)	<0.001
Not Working	6743 (65.1)	5,311 (78.8)	1,432 (21.2)		6307 (93.5)	436 (6.5)	
Parity							
Never pregnant	1226 (11.8)	847 (69.1)	379 (30.9)	<0.001	1155 (94.2)	71 (5.8)	<0.001
<3	2756 (26.5)	2002 (72.6)	754 (27.4)		2539 (92.1)	217 (7.9)	
>3	6406 (61.7)	5203 (81.2)	1203 (18.8)		6085 (95.0)	321 (5.0)	
Wealth index quintile							
Poorest	2069 (19.9)	1486 (71.8)	583 (28.2)	<0.001	1948 (94.2)	121 (5.8)	<0.001
Poorer	1915 (18.4)	1417 (74.0)	498 (26.0)		1790 (93.5)	125 (6.5)	
Middle	2054 (19.8)	1547 (75.3)	507 (24.7)		1892 (92.1)	162 (7.9)	
Richer	2069 (19.9)	1611 (77.9)	458 (22.1)		1934 (93.5)	135 (6.5)	
Richest	2281 (22.0)	1991 (87.3)	290 (12.7)		2215 (97.1)	66 (2.9)	
HF Type							
PPHI	4691 (45.2)	3592 (76.6)	1099 (23.4)	0.037	4359 (92.9)	332 (7.1)	<0.001
Govt.	5697 (54.8)	4460 (78.3)	1237 (21.7)		5420 (95.1)	277 (4.9)	
District							
Dadu	5138 (49.5)	3989 (77.6)	1149 (22.4)	0.760	4743 (92.3)	395 (7.7)	<0.001
Jacobabad	5250 (50.5)	4063 (77.4)	1187 (22.6)		5036 (95.9)	214 (4.1)	

Govt: Government, PPHI: People's Primary Healthcare Initiative, MUAC: Mid-upper arm circumference, SD: Standard deviation; [1]Chi-square test was used to detect the significant association between nutritional status and background characteristics; [2]Independent sample t-test was used to detect difference in mean age between nourished and malnourished groups

Results

Of the 12,739 women approached, 1723(13.5%) were excluded for being pregnant at the time of data-collection. Of the 11,016(86.5%) MWRAs, data of 628(5.7%) was excluded for either missing or implausible MUAC, and the final sample in the current study stood at 10,388(94.3%); 5,138(49.5%) from Dadu and 5,250(50.5%) from Jacobabad. The overall mean age was 32.9±8.1 with 4,739(45.6%) aged 25-35 years. Overall, 2,336(22.5%) subjects were undernourished and 609(5.9%) were severely undernourished (Table-1). Bivariate and multivariable logistic regression showed that age, education, SES and parity were significant predictors of the nourishment status ($p<0.05$), while location and THF were significant predictors of severe under-nourishment ($p<0.05$), but were not related to undernourishment ($p>0.05$). According to goodness of fit, both models had a good fit (Table-2).

Discussion

Maternal nutrition plays a critical role in foetal growth and development, and poor maternal nutrition is not only associated with adverse birth and maternal outcomes, but also has an intergenerational linkage because of its interplay with biological, socio-economic and demographic factors.[12-14] The current study found 22.5% prevalence of under-nourishment and 6% prevalence of severe under-nourishment among MWRAs of districts Dadu and Jacobabad in Sindh. Women's age, education, occupation, parity, SES THF and area of residence were significant predictors of under-nourishment.

Mothers who were aged <25 years were more likely to be under-nourished or severely under-nourished compared to women who were aged 25-35 years. The findings are in line with other studies conducted in India,[15] Bangladesh,[16] Nepal[17] and Tanzania.[18] This may be because women, especially young and adolescent women, in South Asian societies have little or no power in decision-making about food distribution in the household and usually eat the last and the least after feeding all, especially the males, in the household. Literature also suggests that with advancing age and hormonal changes, women gain weight during pregnancies and, therefore, the prevalence of underweight

Table-2: Multivariable hierarchical logistic regression analysis of determinants of under and severe undernourishment among married women of reproductive age (MRWA) in districts Dadu and Jacobabad.

Characteristics	Undernourished (MUAC <23 cm)				Severely undernourished (MUAC <21 cm)			
	Unadjusted OR (95% CIs)	***p-value***	**Adjusted[1]§** OR (95% CIs)	***p-value***	**Unadjusted** OR (95% CIs)	***p-value*** OR (95% CIs)	**Adjusted[2]**	***p-value***
Age (years)								
<25 years	1.94 (1.73 to 2.19)	<0.001	1.68 (1.47 to 1.92)	<0.001	1.68 (1.37 to 2.07)	<0.001	1.68 (1.33 to 2.12)	<0.001
25-35 years	Ref	Ref						
>35 years	0.63 (0.57 to 0.70)	<0.001	0.64 (0.57 to 0.72)	<0.001	0.87 (0.72 to 1.06)	0.166	0.90 (0.74 to 1.11)	0.326
Woman education								
No education	1.98 (1.69 to 2.33)	<0.001)	1.49 (1.24 to 1.78)	<0.001	1.97 (1.45 to 2.69)	<0.001	1.57 (1.13 to 2.20)	0.008
Primary and higher (any)	Ref	Ref						
Occupation								
Not working	0.82 (0.74 to 0.90)	<0.001	-	-	1.39 (1.16 to 1.66)	<0.001	-	-
Working	Ref	-	-	Ref	-	-		
Parity								
Never pregnant	Ref	Ref						
<3	0.84 (0.73 to 0.98)	0.022	0.94 (0.81 to 1.10)	0.433	1.39 (1.05 to 1.83)	0.020	1.51 (1.13 to 2.00)	0.005
>3	0.52 (0.45 to 0.59)	<0.001	0.76 (0.65 to 0.89)	0.001	0.86 (0.66 to 1.12)	0.257	1.08 (0.80 to 1.46)	0.619
Wealth index quintile								
Poorest	2.69 (2.30 to 3.15)	<0.001	2.39 (2.01 to 2.83)	<0.001	2.09 (1.54 to 2.83)	<0.001	2.56 (1.82 to 3.60)	<0.001
Poorer	2.41 (2.06 to 2.83)	<0.001	2.12 (1.78 to 2.52)	<0.001	2.34 (1.73 to 3.18)	<0.001	2.29 (1.65 to 3.17)	<0.001
Middle	2.25 (1.92 to 2.64)	<0.001	2.04 (1.72 to 2.42)	<0.001	2.87 (2.14 to 3.85)	<0.001	2.30 (1.68 to 3.15)	<0.001
Richer	1.95 (1.66 to 2.29)	<0.001	1.80 (1.52 to 2.14)	<0.001	2.34 (1.73 to 3.16)	<0.001	1.88 (1.37 to 2.58)	<0.001
Richest	Ref	Ref						
Health facility type								
PPHI	1.10 (1.01 to 1.21)	0.037	-	-	1.49 (1.26 to 1.76)	<0.001	1.34 (1.13 to 1.59)	0.001
Govt.	Ref	-	-	Ref				
District								
Dadu	0.99 (0.90 to 1.08)	0.763	-	-	1.96 (1.65 to 2.33)	<0.001	2.39 (1.97 to 2.91)	<0.001
Jacobabad	Ref	-	-	Ref				

Govt: Government, PPHI: People's Primary Healthcare Initiative, OR: Odds ratio, CI: Confidence interval, MUAC: Mid-upper arm circumference; [1]The model is adjusted for woman's age, education, parity, and wealth index; [2]The model is adjusted for woman's age, education, parity, wealth index, type of health facility visiting, and the district.; §Good of fit model = *p*-value 0.809; ¶Good of fit = *p*-value 0.262

decreases with age and an increasing number of pregnancies.[15,19] The current study also found a similar trend with parity. Under-nourishment was insignificant among women who had given birth <3 times, but the effect was protective for women who had experienced childbirth three or more times. Severe under-nourishment was still significantly associated with women who had been through childbirth <3 times, but this association disappeared among severely under-nourished women who had given birth three or more times.

Women with no formal education were more likely to be underweight or severely underweight in the current study, and this finding is in line with studies conducted in India,[15,20] Bangladesh,[16] Nepal,[17] Tanzania[18] and Ethiopia.[21] It indicates that uneducated women are less informed about health overall and less empowered to decide for their health and nutrition. Moreover, they may have more tasks outside of the home in terms of fetching clean water and wood/fuel for cooking in addition to usual responsibilities as mothers and housewives. Similarly, women who were not working were severely under-nourished compared to women who were working.

The women belonging to wealthier households were less likely to be under-nourished compared to women from poorer households. It may be because women from the wealthier index have better access to nutritious food and access to healthcare services. Poverty, on the other hand, is associated with poor housing, fewer choices for food, poor water and sanitation, and less purchasing power with respect to nutritious food.[18] These findings are consistent with prior studies conducted in Bangladesh,[16] India,[15] Nepal[17] and Tanzania.[18]

The current study also found that women belonging to PPHI facilities in catchment areas were significantly under-nourished and/or severely under-nourished compared to women visiting government facilities in catchment areas. Similarly, women who were residing in Dadu were more likely to be severely under-nourished compared to Jacobabad. Although these factors have never been studied before in this context, the analyses provide a good indication for further assessment and encourages the government to support the health and nutrition of women of childbearing age.

The current study has several limitations. First, in resource-poor settings, MUAC has increasingly been used to assess underweight/under-nourishment. However, there is no set

cut-off defined for MUAC among WRAs and studies have recommended a cut-off of <23 cm (range: <23cm to <21cm) that corresponds to BMI <18.5kg/m^2. Therefore, the current study used both <23cm and <21cm to categorise under-nourishment and severe under-nourishment among MWRAs and determined the predictors associated with these. Second, due to the cross-sectional design of the study, it could not infer the causality of explanatory predictors upon nutritional outcomes. Third, because the larger IAS did not collect information on dietary diversity, dietary intake, physical activity and household food insecurity, the current study could not assess the probable correlates Fourth, though the findings are generalisable to other districts of Sindh, except for Karachi and Hyderabad, they have limited generalisability to other rural areas of Pakistan. Fifth, the study collected information on a recall basis, and, therefore, the study might have included few women aged <15 years who could not recall the correct year of their birth. However, prompts related to special occasions and events were given to understand if they were born before or after those events. Future studies should investigate the effect of dietary diversity, intra-household food allocation, and physical activity on women's nutritional status.

The current study has its strengths as well. First, it is the first study to assess under-nourishment in rural districts of Sindh. Second, although the measurement error was inevitable, workers were trained and measurements were taken thrice to avoid any errors.

Conclusion

Women who were younger, poor, with no formal education, residing in catchment areas with PPHI health facilities, and who belonged to Dadu district were more likely to be under-nourished or severely undernourished.

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References

1. Global Nutrition Report. 2020 Global Nutrition Report: action on equity to end malnutrition. Bristol, UK: Development Initiatives, 2020.
2. Bhutta ZA, Gazdar H, Haddad L. Seeing the unseen: breaking the logjam of undernutrition in Pakistan. IDS Bull. 2013; 44:1-9.
3. Bhutta ZA, Hafeez A, Rizvi A, Ali N, Khan A, Ahmad F. Reproductive, maternal, newborn, and child health in Pakistan: challenges and opportunities. Lancet. 2013; 381:2207-18.
4. National Nutrition Survey 2018: Key findings report. Islamabad, Pakistan: Unicef and Ministry of National Health Services, 2018.
5. Ilyas U, Parveen K. Malnutrition and its associated risk factors among women of reproductive age in rural community of Lahore. Int J Med Res Health Sci. 2019; 8:173-8.
6. Cesare MD, Bhatti Z, Soofi SB, Fortunato L , Ezzati M , Bhutta ZA. Geographical and socioeconomic inequalities in women and children's nutritional status in Pakistan in 2011: an analysis of data from a nationally representative survey. Lancet Glob Health. 2015; 3:e229-39.
7. Fakier A, Petro G, Fawcus S. Mid-upper arm circumference: A surrogate for body mass index in pregnant women. S Afr Med J. 2017; 107:606-10.
8. Whitfield KC, Wozniak R, Pradinuk M, Karakochuk CD , Anabwani G, Daly Z, et al. Anthropometric measures are simple and accurate paediatric weight-prediction proxies in resource-poor settings with a high HIV prevalence. Arch Dis Child. 2017; 102:10-6.
9. Khadivzadeh T. Mid upper arm and calf circumferences as indicators of nutritional status in women of reproductive age. East Mediterr Health J. 2002; 8:612-8.
10. Reilly JJ. Mid-upper arm circumference (MUAC): new applications for an old measure. Arch Dis Child. 2017; 102:1-2.
11. NIPS. Pakistan Demographic and Health Survey 2017-18. Islamabad, Pakistan; and Rockville, Maryland, USA: National Institute of Population Studies (Pakistan) and ICF, 2019.
12. Desyibelew HD, Dadi AF. Burden and determinants of malnutrition among pregnant women in Africa: a systematic review and meta-analysis. PLoS One. 2019; 14:e0221712.
13. Khatun W, Alam A, Rasheed S, Huda TM , Dible MJ. Exploring the intergenerational effects of undernutrition: association of maternal heigh with neonatal, infant, and under five mortality in Bangladesh. BMJ Glob Health. 2018; 3:e000881.
14. Liu L, Ma Y, Wang N, Lin W, Liu Y, Wen D. Maternal body mass index and risk of neonatal adverse outcomes in China: a systematic review and meta-analysis. BMC Pregnancy Childbirth. 2019; 19:105.
15. 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. Glob Health Res Policy. 2019;4:24.
16. Hashan MR, Gupta RD, Day B, Al Kibria GM. Differences in prevalence and associated factors of underweight and overweight/obesity according to rural-urban residence strata among women of reproductive age in Bangladesh: evidence from a cross-sectional national survey. BMJ Open. 2020; 10:e034321.
17. Rai A, Gurung S, Thapa S, Saville NM. Correlates and inequality of underweight and overweight among women of reproductive age: evidence from 2016 Nepal Demographic Health Survey. PLoS One. 2019; 14:e0216644.
18. Mtumwa AH, Paul E, Vuai SAH. Determinants of undernutrition among women of reproductive age in Tanzania mainland. S Arf J Clin Nutr. 2016; 29:75-81.
19. Gunderson EP. Childbearing and obesity in women: weight before, during, and after pregnancy. Obstet Gynecol Clin North Am. 2009; 36:317-32.
20. Hazarika J, Saikia I, Hazarika PJ. Risk factors of undernutrition among women in the reproductive age group of India. Am Eur J Sci Res. 2012; 7:5-11.
21. Teller CH, Yimar G. Levels and determinants of malnutrition in adolescent and adult women in Southern Ethiopia. Ethio J Health Dev. 2000; 14:57-66.