Determinants of Nutritional Status among Women in South Asian Countries: A Cross-Sectional Study

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Abstract: In spite of decreasing in recent years, malnourished women remain high in South Asian countries. This study aims to assess the determinant of nutritional status among women through body mass index (BMI) in four South Asian countries. This study uses the latest rounds of Demographic Health Survey data from four South Asian countries, such as India 2015-16, Nepal 2016, Pakistan 2012-13, and Bangladesh 2014. Multinomial logistic regression was employed to estimate the relative risk ratio of BMI in South Asian countries. More than half (57%) of the South Asian women aged 15-49 years age group was found normal. The percentage of underweight (21%) is higher than overweight (16%), and less than 6% of women were found obese in South Asia. However, underweight and overweight or obesity were co-existed and accounted for about half of South Asian women. Both bivariate and multinomial analyses reveal that demographic and socio-economic factors significantly influenced the BMI among women in South Asia, including women's age, education, residence, marital status, and wealth quintile. The best way to tackle a nutritional crisis in these areas would be to educate the people, which recommends that nutritional education and family planning should also be extended in South Asia. The government should also integrate and strengthen nutrition policies and programmes through community-based approaches. Finally, more longitudinal studies are needed in South Asian countries to determine the nutritional status of women.

Key words: Nutritional Status, Determinants, Women, South Asia, Body Mass Index

Introduction

Malnourishment, in any manifestation, poses considerable risks to the well-being of people. Currently, the globe confronts a two-fold challenge of malnutrition that encompasses both insufficient nourishment and obesity, particularly in nations with low to middle incomes. Keeping this big challenge in mind, different goals of SDGs (especially goals: 2 and 3) addressed this issue rigorously. In the last decade, interest in studying women malnutrition has experienced a global renaissance and this increased renaissance to this ignored area of research (Black et al., 2008). Undernutrition among women is alarming in developing countries, especially in the South Asian region (Bhandari et al., 2016). More than 3.5 million women die every year in developing countries on account of undernutrition (Black et al., 2008). Moreover, around half of the world's malnourished women live in three developing countries: Bangladesh, India and Pakistan (Ali et al., 2020). In spite of decreasing in recent years, malnourished women remain high across Bangladesh, India, and Nepal. Although in India, this progress

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is slowest, underweight among reproductive age women decreased from 36% to 33% from 1999 to 2006 (Chaparro et al., 2014).

An exclusive study by Chaparro et al. (2014) found that overweight and obesity are relatively lower in South Asian countries and has increased in recent years. In the last three consecutive DHS surveys, the overweight and obesity trend among reproductive aged women was showing upward in India, Bangladesh, and Nepal. This prevalence almost doubled in Bangladesh from 2004 to 2011 (9% to 17% respectively), increased 4% in India from 1999 to 2006, and increased 4% in Nepal from 2006 to 2011. Older women (aged 40-49 years), women residing in urban areas, highly educated, women who belong to the highest wealth quintile households and ethnic groups (e.g. Sikhs in India) (Chaparro et al., 2014). One exclusive study on Pakistan shows that, the main risk factors for women's poor nutritional status include increasing the women's age, educational status, rural residence, and household wealth (Waghmare, Chauhan, & Sharma, 2022).

Although malnutrition is a major public health concern, which is associated with a significant increase in the risk of morbidity and mortality (Khan et al., 2019), the leading cause of poverty (Siddiqui et al., 2020), and reproductive aged women are among the most susceptible to malnutrition for social and biological reasons (Kamal & Islam, 2010). There is a number of literature available that have examined the trend, pattern, prevalence, and factors for nutrition in a broader context, but they are limited to geographical area (Gautam et al., 2019; Harding et al., 2018; Nguyen et al., 2018; Chowdhury et al., 2015; Balarajan et al., 2013). However, as observed globally, there is a lack of studies showing the determinants of nutritional status among women in South Asia. Therefore, this study aims to fulfill that gap somewhat and assesses the determinants of nutritional status among women in South Asia.

Materials and Methods

This study uses the latest rounds of Demographic Health Survey (DHS) data from four South Asian countries: Bangladesh 2014 (BDHS-7), India 2015-16 (NFHS-4), Nepal 2016 (NDHS-5), and Pakistan 2012-13 (PDHS-3). DHS is a nationally representative sample survey covering the country with a well-specified sampling. All these surveys collected anthropometric information on women, however, the selection of an individual for anthropometric measurement differs from country to country. In Bangladesh, height and weight measurements were collected for ever-married women aged 15-49 years. In India, this was only measured for women selected for the state module sub-sample of households aged 15-49 years. In Pakistan, the height and weight were measured to all children under five years; however, it was measured for women aged 15-49 years in every third household selected for male interviews.

Bivariate analysis was used to show the percentage distribution of women by BMI according to background characteristics in selected South Asian countries. Multinomial logistic regression was also employed to estimate the relative risk ratio of BMI in South Asian countries. STATA-16 software was used to carry out the analyses of this study.

Dependent variable: Women's nutritional status will be examined through the BMI, which is categorised into four categories: Underweight, Normal weight, Overweight, and Obesity (Arnold, Nangia, & Kapil, 2004). The BMI is an age-independent anthropometric criterion (Bailey & Ferro-Luzzi, 1995; Word Health Organization, 2000; Anuurad et al., 2003; Prashant & Shaw, 2009; Kamal & Islam, 2010). In this study, BMI was calculated by using the following formula

$$\text{BMI} = kg/m^2$$

Where 'kg' = a person's weight in kilograms, and m^2 = a person's height in metres squared. According to the studies done by Kamal & Islam (2010) and Weir & Jan (2019), the cut-off limit for BMI was Underweight= BMI<18.5 kg/m^2; Normal weight= BMI 18.5 to 24.9 kg/m^2; Overweight= BMI 25.0 to 29.9 kg/m^2, and Obese= BMI>=30.0 kg/m^2 .

Independent variables: The study used demographic and socio-economic factors are: Age of mother (15-19, 20-24, 25-29, 30-34, 35-39, 40-44, and 45-49), place of residence (urban and rural), Women educational level (no education, primary, secondary and higher), sex of the household head (male and female), marital status (never in union, currently married and others), wealth quintile (poorest, poorer, middle, richer and richest), source of drinking water (piped water, tubewell/borewell, protected well, unprotected well, river/dam/springs and others), type of fuel used for cooking (clean, wood, crop residual, animal dung and others), type of toilet facilities (flush toilet, pit latrine, open and other), BMI (underweight, normal weight, overweight and obese).

Results

Figure 1 shows that more than half (57%) of the South Asian women aged 15-49 years age group was found normal. The underweight percentage (21%) is higher than overweight (16%), obese women are found less than 6% in South Asia.

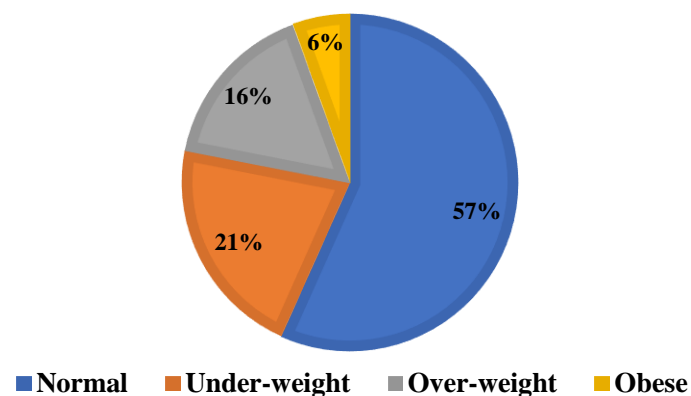**Figure 1:** Distribution of women by body mass index in South Asia

Table 1 shows the percentage distribution of women by BMI according to background variables. The age group distribution shows that 40%, 56%, and 4% of women are underweight, normal, and overweight respectively in the 15–19-year category. The underweight percentage decreases with increasing age, on the other hand, overweight and obese percentages increase with increasing age.

When it comes to country-wise distribution, 18%, 19%, and 4% of women observed underweight, overweight, and obese respectively in Bangladesh. In contrast, in India 22%, 15%, and 5% of women are underweight, overweight, obese respectively and Nepal followed the similar stories. In contrast, Pakistan shows a different result that 8%, 30%, and 21% of women are underweight, overweight and obese. The highest percentage of underweight women found in India (22%) and the highest percentage of normal women found in Nepal (61%) followed by Bangladesh (58%) whereas the highest percentage of overweight (30%) and obese (21%) women found in Pakistan. Underweight and normal women were found more in rural areas (25% and 59% respectively) than that in urban areas. But the urban area has more overweight (23%) and obese (10%) than that of rural areas.

Table 1 shows that 21%, 16%, and 6% of male household heads were observed underweight, overweight, and obese respectively. On the other hand, 22%, 16%, and 5% of female household heads were observed as underweight, overweight, and obese. A negligible difference exists between males and females in underweight, overweight, and obese. The result shows BMI is equally distributed among women and male household heads.

The BMI distribution with educational attainment shows that 23%, 14%, and 4% were observed underweight, overweight, and obese in the no education category. The reverse situation observed in the higher education category that is 14%, 21%, and 7% of women were underweight, overweight, and obese respectively. The normal category shows the highest percentage in the no education category, whereas the lowest percentage is observed in the secondary education category. The highest percentage of women (30%) was found in the household where the source of drinking water was an unprotected well whereas the highest percentage of overweight women (20%) was found in the household where the source of drinking water was Unprotected well.

The type of fuel used for cooking shows that those who use clean fuel, 14%, 24%, and 10% women are underweight, overweight, and obese respectively. About 26%, 27%, and 28% are underweight who use wood, crop residual, and animal dung respectively. The highest percentage of women (28%) found underweight who use animal dung for cooking. The highest percentage of underweight women (37%) was found among those who were never in union whereas the highest percentage of overweight women (19%) was found among those who were currently married.

The prevalence of underweight changes based on the toilet facility. The highest percentage of underweight (31%) was observed in the open category whereas the highest percentage of overweight (22%) and obese (9%) were found in the flush toilet category. The lowest percentage of overweight (15%) and obese (4%) were found in the open category. Regarding the wealth quintile, in the poorest category, 34%, 6%, and 1% of women are underweight, overweight, and obese respectively. In the

underweight category, the percentage starts declining from the poorest to the richest. The richest category shows that 11%, 27%, and 12% of women are underweight, overweight, and obese respectively.

Table 1. Percentage distribution of women by body mass index according to background characteristics in selected south Asian countries

Characteristics	Under weight	Normal	Over weight	Obese
Country				
Bangladesh	18.18	58.30	19.19	4.33
India	22.45	57.14	15.39	5.02
Nepal	16.81	61.21	16.94	5.03
Pakistan	7.96	40.80	30.21	21.03
Age of mothers				
15-19	39.65	55.55	3.91	0.89
20-24	26.14	61.85	9.72	2.29
25-29	19.26	60.04	16.27	4.43
30-34	15.67	56.45	20.89	6.99
35-39	13.88	55.06	22.41	8.66
40-44	14.06	52.35	24.15	9.43
45-49	13.68	51.53	24.88	9.90
Place of residence				
Urban	14.57	52.71	23.18	9.55
Rural	24.87	58.74	12.89	3.49
Sex of household head				
Male	21.27	56.68	16.46	5.59
Female	22.14	56.82	15.84	5.20
Educational attainment				
No education	23.34	58.53	13.88	4.25
Primary	20.67	56.92	16.81	5.61
Secondary	22.26	55.42	16.52	5.81
Higher & above	14.46	56.96	21.12	7.46
Source of drinking water				
Piped water	18.24	54.58	19.66	7.52
Tubewell/borewell	24.22	58.64	13.39	3.74
Protected well	16.43	57.67	20.49	5.41
Unprotected well	30.17	59.28	8.75	1.80
River/dam/springs	21.80	61.15	13.07	3.97
Others	18.81	53.97	19.37	7.85
Type of fuel used for cooking				
Clean	13.90	52.52	23.70	9.89
Wood	26.24	59.26	11.74	2.76
Crop residual	26.70	61.09	10.36	1.85
Animal dung	27.82	60.08	9.84	2.26
Others	22.88	57.12	15.40	4.60
Current marital status				
Never in union	37.27	56.15	5.16	1.42
Currently married	17.52	56.90	19.08	6.50
Others	19.37	55.59	18.19	6.85
Type of toilet facilities				
Flush toilet	15.73	53.93	21.67	8.68
Pit latrine	20.05	60.31	16.10	3.55
Open	30.50	59.23	8.53	1.75
Other	22.40	57.85	15.29	4.47
Wealth quintile				
Poorest	33.61	59.61	5.77	1.00
Poorer	27.44	59.97	10.36	2.23
Middle	21.57	58.45	15.68	4.30
Richer	15.83	55.21	21.32	7.63
Richest	10.53	50.87	26.89	11.71
Total	**21.38**	**56.70**	**16.38**	**5.54**

Source: Demographic and Health Survey: Bangladesh- 2014, India-2015-16, Pakistan-2017-18, Nepal-2016

The multinomial logistic regression results show that the relative risk ratio of BMI in South Asian countries has been discussed as follows: Table 2 shows that there are 3%, 30%, and 46% lesser chances of being underweight in India, Nepal, and Pakistan respectively than in Bangladesh. There are 25% and 18% lesser chances of overweight in India and Nepal than in Bangladesh, whereas 2.19 times higher chance of getting overweight in Pakistan compared to Bangladesh. Obesity follows a similar story to overweight; women in Pakistan are 6.06 times more likely to get obese when compared to Bangladeshi women.

Table 2 shows that statistical significance has been observed in all age groups. Around 21% less underweight chance in the age group 20-24 years than age group 15-19 years in Asian countries. Similarly, 48% less underweight chance in the 30-34-year age group compared to 15-19 years. When it comes to overweight, the percentage of higher chances of having overweight varies from 1.65 to 5.48 times in 20-24 to 45-49 age group women as compared15-19-year age group. Similarly, obese the percentage of higher chances of having overweight varies from 1.74 to 10.18 times in 20-24 and 45-49 age group women as compared 15-19-year age group.

When we discuss the place of residence, there are 15% lesser chances of overweight and 24% lesser chance of obesity than urban reproductive-aged women. On the other hand, 1.10 times rural women have a higher chance of getting underweight than urban women. Those household women who belong to the female-headed family have a 3% lesser chance of getting underweight compared to the male-headed, 1.05 and 1.03 times more chance of getting overweight and obese respectively when compared to the male-headed family respectively.

When we talk about the source of drinking water, the table shows that 5%, 14%, and 19% use tubewell/borewell, protected well, and River/dam/springs respectively less underweight than piped water. There is a 1.04 and 1.0 times higher chance of underweight those using unprotected wells and other water sources than piped water. In other had overweight category, 6%, 20%, and 7% lesser chances of obese those who are using tubewell/borewell, unprotected well and River/dam/springs respectively as compared to piped water, whereas, 1.01 and 1.11 times are more likely to be overweight when using protected well and others respectively, compare to piped water. In the obesity category, 36% to 8% are less likely to get obese who use tubewell/borewell, protected well, unprotected well, and River/dam/springs compared to a piped water source.

The education category shows that 14% to 37% in primary education to higher education are less likely to get underweight compared to no education. The overweight and obesity have a similar result, 1.19 to 1.25 times primary to higher education more likely to be overweight than no education, whereas 1.28 to 1.12 times more likely to obese compared to no education. Regarding top wealth quintile, the result shows that 16% to 53% poor to the richest category are less likely to be underweight than the poorest. The overweight and obesity have a similar result, 1.65 to 3.28 times poorer to richest more likely to be overweight compare to poorest, whereas 1.86 to 5.70 times poorer to richest more likely obese compare to the poorest.

Table 2. Results of multinomial logistic regression relative risk ratio of BMI in south Asian countries

Characteristics	Under-weight	Overweight	Obese
Country			
Bangladesh ®			
India	0.97** (0.95-1.00)	0.75*** (0.74-0.78)	0.90*** (0.86-0.94)
Nepal	0.70*** (0.66-0.75)	0.82*** (0.77-0.88)	0.93 (0.83-1.05)
Pakistan	0.54*** (0.51-0.57)	2.19*** (2.11-2.88)	6.06***(5.73-6.43)
Age of mothers			
15-19 ®			
20-24	0.79*** (0.78-0.81)	1.65***(1.59-1.72)	1.74***(1.61-1.89)
25-29	0.63*** (0.61-0.64)	2.66***(2.55-2.77)	3.26***(3.02-3.53)
30-34	0.52*** (0.51-0.53)	3.76***(3.61-3.92)	5.72***(5.18-6.18)
35-39	0.45***(0.44-0.47)	4.34*** (4.16-4.52)	7.67***(7.10-8.30)
40-44	0.47*** (0.46-0.48)	5.10*** (4.89-5.32)	9.34***(8.64-10.11)
45-49	0.45*** (0.44-0.47)	5.48*** (5.25-5.72)	10.18***(9.41-11.02)
Place of residence			
Urban ®			
Rural	1.10*** (1.08-1.12)	0.85*** (0.83-0.86)	0.76***(0.74-0.78)
Sex of household Head			
Male ®			
Female	0.97*** (0.95-0.99)	1.05*** (1.03-1.07)	1.03 (0.99-1.06)
Source of drinking water			
Piped water ®			
Tubewell/borewell	0.95*** (0.93-0.96)	0.94*** (0.92-0.96)	0.86*** (0.84-0.89)
Protected well	0.86*** (0.82-0.89)	1.01* (0.97-1.05)	0.74*** (0.69-0.79)
Unprotected well	1.04** (1.01-1.07)	0.80*** (0.76-0.84)	0.64*** (0.58-0.70)
River/dam/springs	0.81*** (0.77-0.85)	0.93** (0.87-0.99)	0.92 (0.83-1.02)
Others	1.00 (0.97-1.03)	1.11***(1.08-1.15)	1.26***(1.21-1.31)
Type of fuel used for cooking			
Clean ®			
Wood	1.09*** (1.07-1.11)	0.80***(0.78-0.82)	0.66***(0.64-0.69)
Crop residual	1.04** (1.01-1.07)	0.78*** (0.76-0.82)	0.59***(0.55-0.64)
Animal dung	1.04** (1.01-1.07)	0.80*** (0.78-0.83)	0.70***(0.66-0.76)
Others	1.11*** (1.07-1.16)	0.92*** (0.88-0.96)	0.83***(0.77-0.89)
Type of toilet Facilities			
Flush toilet ®			
Pit latrine	0.95*** (0.93-0.98)	0.91*** (0.89-0.94)	0.80***(0.77-0.84)
Open	1.12*** (1.10-1.14)	0.84*** (0.82-0.86)	0.70**(0.68-0.74)
Other	0.95**(0.91-0.99)	0.97(0.93-1.02)	0.90**(0.83-0.98)
Current marital status			
Never union ®			
Currently married	0.59*** (0.58-0.60)	1.77***(1.72-1.83)	1.55***(1.46-1.64)
Others	0.72*** (0.70-0.75)	1.45***(1.38-1.52)	1.34***(1.52-1.46)
Educational attainment			
No education ®			
Primary	0.86*** (0.84-0.88)	1.19** *(1.16-1.22)	1.28*** (1.24-1.34)
Secondary	0.78*** (0.77-0.80)	1.32** *(1.30-1.35)	1.41*** (1.37-1.46)
Higher & above	0.63*** (0.62-0.65)	1.25*** (1.22-1.29)	1.12*** (1.07-1.17)
Wealth quintile			
Poorest ®			
Poorer	0.84*** (0.82-0.85)	1.65*** (1.60-0.70)	1.86***(1.74-2.00)
Middle	0.71*** (0.70-0.73)	2.24*** (2.17-2.31)	2.92***(2.73-3.12)
Richer	0.60***(0.59-0.62)	2.74*** (2.64-2.83)	4.14***(3.86-4.44)
Richest	0.47***(0.45-0.48)	3.28*** (3.16-3.40)	5.70**(5.30-6.14)

Note- ® Reference category: *=P<0.05, ** =P <0.01, ***=P<0.001
Source: Demographic and Health Survey: Bangladesh- 2014, India-2015-16, Pakistan-2017-18, Nepal-2016

Discussion

The study provides an overall picture of South Asian countries' nutritional status of women by using BMI. Overall, the proportion of BMI varies in South Asian countries, this may be because of differences in their dietary patterns and divergence of geographical, and cultural factors (Kamal & Islam, 2010; Bhandari et al., 2016). The study findings revealed that more than half (57%) of the South Asian women were having normal weight and over one-fifth of women were underweight and nearly one-fourth of women were overweight and obese. However, both underweight and overweight or obesity were co-existed and accounted for about a half in the South Asian women.

Nevertheless, both bivariate and multinomial analyses reveal that socioeconomic and demographic factors significantly influenced the BMI among women in South Asia, these including women's age, education, place of residence, marital status, and wealth quintile (Table 1 & 2) (Waghmare, Chauhan, & Sharma, 2022) . In this study, the underweight percentage decreases with age, but the overweight and obese percentages increase as age increases. However, a similar result found that the BMI proportion increases with age (Bhandari et al., 2016; Waghmare, Chauhan, & Sharma, 2022). Research studies from South Asia showed the percentage of underweight among women was significantly higher in rural areas compared to urban communities, whereas women who resided in urban areas were more likely to be suffering from overweight and obesity compared to rural areas (Acharya, Bhatta & Timilsina, 2017; Waghmare et al., 2022). This study also supports the same findings on rural settings, which were significant in the case of the percentage of underweight.

Moreover, the women who were never married were more likely to have a lower BMI than those currently married in South Asia. More surprisingly, those with formal education have had bad nutritional status compared to those with informal education. Bhandari et al. (2016) found similar results; therefore, this needs to verify from other large-scale studies from South Asia. This study also found that the wealth quintile is the most important determinant of nutritional status. The severity of nutritional status among South Asian women was more in the poorest wealth quintile and this was increasing with increase their wealth status. A similar result exists between the wealth index and the nutritional status of women in South Asia (Khan & Kraemer, 2009). However, the sex of the household, type of toilet facility, source of drinking water, and type of used for cooking did not significantly affect nutritional status in South Asia.

Although BMI is a more accurate measure, this has been mainly for research purposes; however, this index has had limited application in clinical medical practices and is not applicable as a public health tool (Bailey & Ferro-Luzzi, 1995). Further, BMI is a crude index, which is not considered the fat distribution, this may vary in different individuals and populations (Kamal & Islam, 2010). In this study, the DHSs data used from the four South Indian countries were taken from different years and periods between the surveys.

Strength and limitation of the study

This study made use of information collected from four surveys that were representative of the entire country, providing estimates that could be compared on a national level. Nonetheless, a significant drawback was that the study's cross-sectional design prevented us from establishing causal relationships between variables.

Conclusion

The study concludes that over one-fifth of women were underweight and about one-fourth of women were overweight and obese in South Asia. Overall, the socio-economic and demographic factors, i.e., education, wealth quintile, place of residence, marital status, and women's age were significantly affected the nutritional status. Thus, the study concludes that women's higher education and wealth leads to less risk of being underweight in South Asia and vice-versa. Moreover, the best way to tackle the nutritional crisis in these areas would be to educate the people, which recommends that nutritional education and family planning should also be extended in South Asia. The government should also integrate and strengthen nutrition policies and programs through community-based approaches (Acharya et al., 2017). Even though BMI-related factors are also prevalent, which need solutions to overcome the excess underweight, especially in the lower socio-economic groups (Kamal & Islam, 2010). Poor households should be provided special attention to improve the nutritional status among women in poor households (Waghmare, Chauhan, & Sharma, 2022). Finally, more longitudinal studies are needed in South Asian countries to determine the nutritional status of women (Nishida, 2004).

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