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## ORIGINAL ARTICLE

# Relationship of Maternal Body Mass Index and Socio-Economic Status with Stunting and Wasting: A Survey on Children Under Five Dwelling in Southern Punjab, Pakistan

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### ABSTRACT

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**Objective:** To assess the relationship of maternal body mass index (BMI) measurements and socioeconomic status with wasting and stunting among children under five years of age dwelling in rural areas of district Multan.

**Study Design:** A cross-sectional survey was evaluated on 332 children of age under five years and 187 mothers.

**Place and Duration of Study:** The study was conducted in Southern Punjab during the month of January-June 2019.

**Material and Methods:** Participants were measured for their sociodemographic and anthropometric features to calculate BMI for mothers and height for age (stunting) and weight for height (wasting) for children under five.

**Results:** Mothers aged ( $28.2 \pm 5.2$  years) and had a lower socioeconomic status (90.4%). The study showed an overall prevalence of stunting (22%) and wasting (28.3%) significantly higher among girls. The relationship of stunting and wasting along with the mother's BMI and socioeconomic status was non-significant  $p > 0.05$ .

**Conclusion:** The study revealed that maternal health and BMI had positive outcomes for child health. Socioeconomic status proved to be a non-significant factor for stunting and wasting when a mother breastfeeds their child properly.

**Key Words:** Wasting, Stunting, Maternal BMI, Height-for-age, Weight-for-height

### INTRODUCTION

Malnutrition among children under five years is a major public health problem, especially in many low-income and middle-income countries. Globally an estimated 52 million children are wasted (16 million severely wasted) and 155 million children are stunted.<sup>1</sup> Every year, approximately 800,000 deaths are related to wasting, 60% of these are

liable for severe wasting.<sup>2</sup> Recent approximations showed that globally about 13 million infants are born with intrauterine growth retardation, 178 million are stunted, a greater part of which live in South-East Asia.<sup>3</sup> The African region and South-East Asia have reported the highest prevalence of under-nutrition for about 39.4% of the stunted and 10.3% of the wasted children under-5 years of

age. In Bangladesh, 16% of children under five years of age are wasted and 41 % are stunted.<sup>4</sup>

Stunting is defined as the percentage of children under 5-years of age whose height for age is below minus two standard deviations (moderate and severe stunting) and minus three standard deviations (severe stunting) from the median of the World Health Organization Child Growth Standards) South-East Asia and the region of Africa have stated the maximum incidence of under-nutrition, with the previous accounting aimed at about 39.4% of the stunted and 10.3% of the children under-5 years are wasted.<sup>5</sup>

Childhood undernutrition, in the form of stunting and wasting, is an important contributing factor to the elevated levels of childhood illness and death in developing countries. Sub-Saharan Africa has high rates of stunting in children under-5 years of age, with the percentage of stunted children being 41%. The nutritional status of children is an indication of the socioeconomic status of the family and the social security of the community. Indeed, there is a well-known association between child nutrition and socioeconomic status.<sup>6</sup>

State of the world children's report by UNICEF (2020) states that the under-nutrition pace is still high in the world ranking at 22.0% stunting and 6.7% wasting for children under-5 years of age. In Kenya, the stunting rate of these children points at 26%, which is higher than the standard world rate.<sup>7</sup> In Bangladesh, 16% in under five years of age children are wasted and 41% are stunted. Furthermore, in an existing report, Bangladesh is ranked number fifth in total wasting of children and number sixth in a total of stunting.<sup>4</sup>

A cross-sectional study was conducted in four villages of Tharparkar district of Sindh, Pakistan of children aged 6 and 59 months. The data were collected according to the WHO standards from mothers and children. Each village was considered a cluster and data were collected randomly. A total of 304 children were added to data in which 172 (56.6%) were boys and 132 (43.4%) were girls. Total 117 (38.5%) children were stunted. Children of age 3 were found more stunted. No significant difference was found in males and females. Stunting was most common in both sexes. Family income and education of the mother can decrease the status of stunting.<sup>8</sup>

Another cross-sectional study was done in 2018 in rural communities of Ethiopia by Getahun Ersino to access the factors related to child and maternal undernutrition. Simple random sampling was used for collecting sample mother and children were included in the study. Maternal short-stature prevalence was 1% to 5%. 22% of mothers had (BMI <18.5). The prevalence of stunting is high Halaba communities in children less than 5 years of age is 54%. In Zenway community the prevalence of stunting is 20%. The study reported high levels of stunting and moderate to a high level of maternal undernutrition.<sup>9</sup>

In the developing world, more than 177 million children age under five are stunted, the utmost reason for this is a result of inadequate diet and high transmittable disease burden in young age. Though some children never recover when born stunted, most of them are born with normal height according to the standard of WHO and get stunted as they grow up. Maternal height and weight gain in the period of pregnancy is linked with both weight and height at the time of birth in developing countries. Infectious diseases, including, but not limited to, respiratory and enteric infections, can cause reduced height for age and weight for height through the decreased, altered, and irregular dietary intake.<sup>10</sup>

According to the UNICEF national nutrition survey 2018 a high incidence of stunting (40.2%), wasting (17.7%), and underweight (28.9%) was observed among children under five in Pakistan. Current statistics from the UNICEF showed that 10% of underweight offspring under five years of age in the developing countries are rigorously underweight. The study found that of the children studied 9.5% were severely wasted, 11% severely underweight, and 22.4% rigorously stunted.<sup>11</sup> Maternal anthropometric markers such as BMI are important determinants of under-nutrition in children. Maternal under-nutrition (BMI <18.5 kg/m<sup>2</sup>) in early pregnancy has been shown to increase the risk of unfavorable pregnancy outcomes, including intrauterine growth restriction and preterm infants.

Children born to underweight mothers had a 21% higher risk of being stunted.<sup>12</sup> Maternal over-nutrition with (BMI ≥25), is associated with fetal death, a higher rate of child mortality, and childhood obesity.<sup>13</sup> The prevalence of stunting in

Pakistan is 45% among children less than five years of age, the highest percentage of severe stunting is 31% among children age 24-35 months. Wasting is highest among children age 6-8 months is 20%. The percentage of underweight is 34% among children age 9-17 months.<sup>14</sup>

This study was designed based on the demographic health surveys (DHS) 2017 conducted in Pakistan. DHS are nationally representative household surveys to provide data on various health and demographic indicators. Using DHS methodology and research design this study aimed to find the relationship between stunting, wasting with maternal BMI, and socioeconomic status.

## MATERIAL AND METHODS

The cross-sectional study design was conducted to measure the prevalence of stunting and wasting of children under five in Sujha-Abad, Khokaran, Chah Faith-e-wala, Chah Ghaziwlaa, Bucth station, Basti Darkhanwala villages of district Multan. The data was collected only once from the selected population during the month of January-June 2019.

District Multan is located in the south region of province Punjab and approximately 5 million inhabitants live in the area. Multan district is further divided into four tehsils with more than 2.6 million people lives in rural areas.

Data were collected from 187 mothers and their 332 children under five years of age living in the study areas for at least one year before the start of data collection. Mothers aged 15-49 years with at least one child under five were selected. Pregnant women and women without children, children without mothers, and children with chronic diseases were excluded from the study. The study was conducted according to Helsinki Ethical Consideration 2008 and institutional review board ethical approval (IRB-USA-FLHS/115/2018).

A two-stage sampling technique was used for selecting the clusters and collecting the data using a purposive method from the children under five and their mothers following the inclusion-exclusion criteria.

Anthropometric measurements were recorded for each mother using the height and weight machine, Camry, ZT-160 (accuracy  $\pm$  0.5 kg). A

customized (L=45 cm, W=30 cm) infantometer was used to measure the height of children less than two years of age had a measuring accuracy of  $\pm 0.1$  cm.

The analysis of the data was performed using IBM SPSS (Statistical Package for the Social Sciences) version 23. Socioeconomic status was measured according to the Modified BG prasad scale by monthly income. Anthropometric indicators were calculated according to WHO growth standards, wasting (weight for height, WHZ), and stunting (height for age, HAZ) calculated in Z-score levels. Associations of the variables were calculated using the Chi-square independence test. A p-value of less than 0.05 was considered statistically significant at 95 % of the confidence interval.

## RESULTS

A total of 187 mothers aged (Mean  $\pm$  S.D = 28.2  $\pm$  5.2 years) participated in this study. Most of the mothers (52.4%) fall in the age group of 26-35 years and were illiterate (98.4%) and had a lower socioeconomic status (90.4%). Mothers were calculated for their BMI and 55.6% had normal BMI with common breastfeeding practices (83.42%) of a minimum of five months (71.66%) to their children under five years of age as shown in table 1.

**TABLE 1: Sociodemographic and anthropometric features of the mothers**

Variable	Groups	Frequency (n=187)	Percent- age
Age (Years)	18-25	70	37.4
	26-35	98	52.4
	36-45	19	10.2
Socioeconomic Status	Lower	169	90.4
	Middle	18	9.6
Education Level	Illiterate	184	98.4
	Literate	3	1.6
Body Mass Index (kg/m <sup>2</sup> )	Underweight	25	13.4
	Normal	104	55.6
	Overweight	45	24.1
	Obese	13	7
Number of Children < 5 years	Child One	76	40.6
	Child Two	77	41.2
	Child Three	34	18.2
Breastfeeding practices	Yes	156	83.4
	No	31	16.6
Duration of Breast Feeding	1-2 Months	21	11.2
	3-5 Months	134	71.7
	6-8 Months	1	0.5

Some of the participated mothers who had up to

three children (18.2%) under the age of five at the time of the study. Data was collected from 332 children aged under five (Mean  $\pm$  S.D = 34.4  $\pm$  15.9 months). Among these children, 184 (55.5%) were male and recorded in the age group of 36-59 months (55.1%). Children were measured for their height and weight to calculate the stunting and

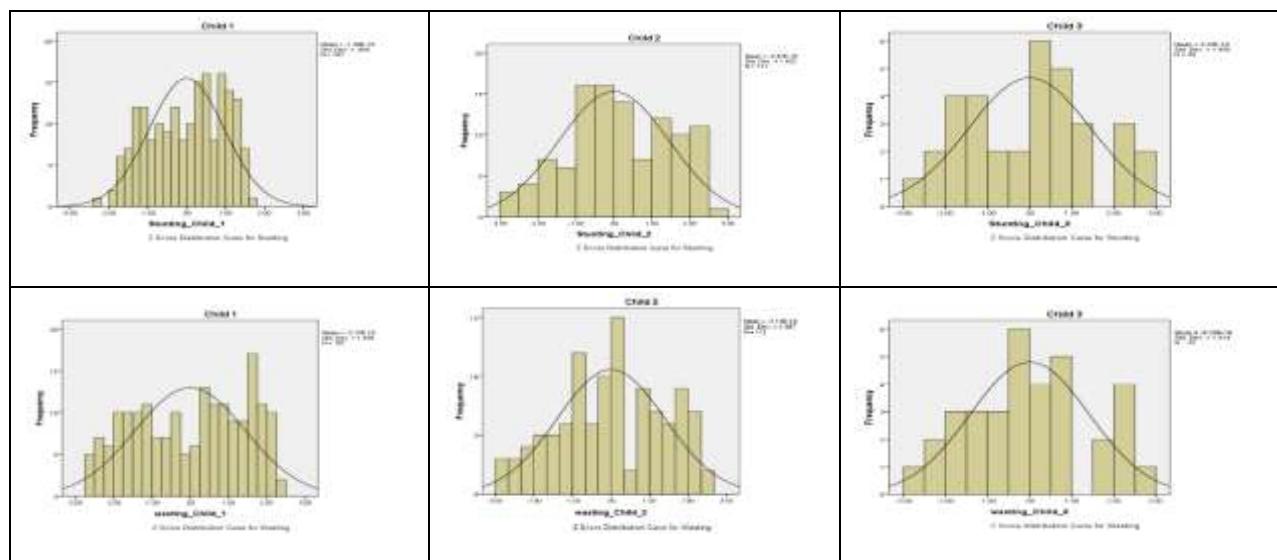
wasting using the World Health Organization Z score chart. The children were categorized into short (< -2 Z score), normal (-1 to +1 Z score) and taller (>+2 Z score) for stunting and were categorized into underweight (< -2 Z score), normal (-1 to +1 Z score) and Overweight (> +2 Z score) for wasting<sup>11</sup> as shown in fig 1 and table 2.

**TABLE 2: Anthropometric features of the children under five (n=332)**

Order of Children	Gender		Children Age Groups			Age (Months)	Height (cm)	Weight (kg)	Total
	Male n(%)	Female n(%)	5-11 Months n(%)	12-23 Months n(%)	24-35 Months n(%)				
Child 1	107 (57.2)	80 (42.8)	19 (10.2)	35 (18.7)	27 (14.4)	106 (56.7)	34.57 (16.57)	81.93 (14.11)	11.76 (2.73) 187 (100.0)
Child 2	56 (29.9)	55 (29.4)	6 (5.3)	15 (13.3)	29 (26.15)	61 (55.0)	35.35 (14.61)	83.10 (13.37)	12.18 (3.88) 111 (100.0)
Child 3	21 (11.2)	13 (7.0)	5 (15.6)	7 (21.9)	6 (17.6)	16 (47.1)	30.35 (15.70)	77.82 (13.76)	10.6 (3.42) 34 (100.0)
<b>Total</b>	<b>184 (55.5)</b>	<b>148 (44.5)</b>	<b>30 (9.0)</b>	<b>57 (17.2)</b>	<b>62 (18.7)</b>	<b>183 (55.1)</b>	<b>34.40 (15.87)</b>	<b>81.90 (13.87)</b>	<b>11.77 (3.77) 332 (100.0)</b>
			Short	Normal	Taller		Under-weight	Normal	Over-weight
Child 1			40 (21.4)	112 (59.9)	35 (18.7)		59 (31.6%)	70 (37.4%)	58 (31.0)
Child 2			24 (12.8)	53 (28.2)	34 (18.2)		26 (13.9%)	54 (28.9%)	31 (16.6)
Child 3			11 (5.9)	15 (8.0)	8 (4.3)		9 (4.8%)	18 (9.6%)	7 (3.7)
<b>Total</b>			<b>75 (22.65)</b>	<b>180 (54.2)</b>	<b>77 (23.2)</b>		<b>94 (28.3%)</b>	<b>142 (42.8%)</b>	<b>96 (28.9)</b>

**TABLE 3: Comparison between mother BMI and socioeconomic status with children stunting and wasting (n=187)**

	Stunting			Wasting				Chi-square p-value
	Normal	Taller	Short	Under-weight	Normal	Over-weight	Chi-square p-value	
BMI Mother	Underweight	19 (5.7)	11 (3.3)	10 (3.0)	13 (3.9)	14 (4.2)	13 (3.9)	0.58
	Normal	102 (30.7)	40 (12.0)	47 (14.2)	54 (16.3)	85 (25.6)	50 (15.1)	
	Overweight	46 (13.9)	23 (6.9)	12 (3.6)	20 (6.0)	32 (9.6)	29 (8.7)	
	Obese	13 (3.9)	3 (0.9)	6 (1.8)	7 (2.1.0)	11 (3.3)	4 (1.2)	
	<b>Total</b>	<b>180 (54.2)</b>	<b>77 (23.2)</b>	<b>75 (22.6)</b>	<b>94 (28.3)</b>	<b>142 (42.8)</b>	<b>96 (28.9)</b>	
Socio-economic Status	Low	161 (48.5)	68 (20.5)	66 (19.9)	0.93	82 (24.7)	127 (38.3)	86 (25.9) 0.84
	Middle	19 (5.7)	9 (2.7)	9 (2.7)		12 (3.6)	15 (4.55)	10 (3.0)
	<b>Total</b>	<b>180 (54.2)</b>	<b>77 (23.2)</b>	<b>75 (22.6)</b>		<b>94 (28.3)</b>	<b>142 (42.8)</b>	<b>96 (28.9)</b>



**Fig1: Z score for stunting and wasting for children under five**

A chi-Square independence test was applied to compare the relationship between mother BMI and Socioeconomic status with child stunting and wasting. The results of this study showed a non-significant relationship  $p > 0.05$  for these variables as shown in table 3.

## DISCUSSION

This cross-sectional study was carried out in rural areas of district Multan to measure the prevalence of stunting and wasting with maternal BMI and socioeconomic status. The study showed that the prevalence of stunting was 22.6% and wasting was 28.3% among children under five in the study area. The prevalence was lower because the women in the region had common breastfeeding practices and used cow milk to nourish their children. In a study conducted in Ethiopia children stunting and wasting was related to maternal undernutrition where mothers reported less than usual dietary consumption<sup>15</sup> The district variations in the nutritional status of children may be due to alterations in socio-economic status, social safety, traditional values, and poor availability of education and health facilities for mother and child.<sup>9</sup>

The results showed that Punjab has a lesser amount of stunting and wasting in children less than five years of age than other regions, though it appears there was an increased prevalence of

overweight and obesity in mothers. There is a high prevalence of maternal underweight (i.e. low BMI) in certain poorest regions of Pakistan.<sup>16</sup> In our study, the mothers were unaware of nutrition and its benefits on health because of illiteracy. A study in Nepal showed that 58% of mothers of undernourished children did not have sufficient knowledge about the dietary necessities of the child and the nutritional importance of food items.<sup>17</sup>

Our study revealed that not only maternal BMI and socioeconomic are determinants of child stunting and wasting but other conditions like education of mother, awareness of nutrition, nutritional status of the child, availability of food, poor hygienic conditions, poor sanitation are also considerable factors for childhood stunting and wasting. In most developing countries women are illiterate, early marriage is common, and fertility proportions are high, which might contribute significantly to the vicious cycle of mothers and child under-nutrition.

A study conducted in Sindh showed that household food insecurity was associated with wasting but not with stunting and underweight.<sup>18</sup> Another study conducted in different areas of Pakistan showed that the possibility of wasting was greater in those children whose mothers were underweight. The study also showed that between the several causes related to stunting, household

income was most significantly correlated. The chances of being stunted were significantly higher among children with the lowest socioeconomic status.<sup>19</sup> Similarly, our study results showed that those children who belong to a low socioeconomic status had more percentage of stunting than those with middle socioeconomic status and there is no significant relationship between stunting and low maternal BMI.

Stunting and wasting most of the time have common causes of malnutrition and sometimes can contribute to the development of one another, children with severe wasting are often stunted. Wasting may be a reason for stunting. Fat supplies are extremely depressed in cases of wasting. In our study, there were not clear factors of stunting and wasting. The outcome of stunting on fat stores is not so clear. Body fat and lesser skinfold thickness have been described in stunted children. Also, stunted children can similarly be overweight in relation to weight-for-height, signifying they could also have extra body fat. In the absence of infection, as noted above, fat is the chief fuel for the organism in case of inadequate energy consumption. The survival can consequently be associated with fat mass.<sup>20</sup>

A lesser intake of nutrients required for lean tissue synthesis and bone growth may describe the possible relationship of stunting with less muscle mass and average or even increased fat stores. The potential mechanism is sustained by the observation that nutrients with inadequate zinc content are related to decreased height gains and extra fat deposition throughout the catch-up development of children with SAM.<sup>21</sup>

The reason for stunting in most countries is due to a combination of exposures, sometimes due to lack of specific micronutrients and the quality of food. Some other issues are environmental exposures or access to the handling of communicable diseases, and these potential causes sometimes causes wasting in early years of life. Comprehensive follow-up and international studies with standardized protocols and longitudinal studies should be done in different countries and cultures to determine the role of wasting in stunting. Childhood malnutrition is a risk element for juvenile illness and death and attained growth has been linked with economic productivity plus well-being in later life.<sup>22</sup> Contrary

to these findings the influence of socioeconomic status on stunting was not significant in a study conducted in Iran. Other aspects like education of the mother had more effect on stunting than socioeconomic status.<sup>23</sup>

A study showed an important interaction between socioeconomic status and maternal height and its relationship with child stunting. The interface showed that between short mothers there was a correspondingly high incidence of stunting through all quintiles from the richest to the poorest families. Nevertheless, the study found an effect of social dissimilarities on stunting, which has been described in previous studies between the children of the tall mothers but not between the children of the short heighted mothers. This study showed a robust relationship between the short height of the mothers and the possibility of their children stunting after alteration for socioeconomic status, although the risk was greater for the mothers whose height was <145 cm.<sup>24</sup>

A study conducted in Bangladesh showed that the association between low maternal BMI and child wasting may be intermediated through deprived birth consequences that have been linked with low maternal BMI. The study also showed that there are more chances of girls to be wasted than boys in Afghanistan, Bangladesh, India, and Pakistan.<sup>25</sup> Our study showed no significant relationship showed between maternal BMI and wasting of the child in the study as many of them had their livestock and availability of cow milk.

## CONCLUSION

The results of the study show that malnutrition is the main public health problem among children under five years of age. But the prevalence rate of malnutrition (stunting and wasting) among children under five was less prevalent in Punjab as the study area was district Multan. Mothers with normal BMI or overweight had children with a normal weight for height and height for age. The study revealed that maternal health and BMI had positive outcomes for child health. Socioeconomic status proved to be a non-significant factor for stunting and wasting when a mother breastfeeds their child properly.

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