Original Article

# Undernutrition among Under-Five Children in Western Maharashtra

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ABSTRACT

**Background:** Undernutrition in under-five children still remains a major public health problem. Most of the under-five deaths are due to undernutrition, putting the child at more risk of catching common infections. The contributing factors for undernutrition may differ from one region to another. **Aim:** The aim of this study was to study undernutrition in rural under-fives. **Settings and Design:** A cross-sectional study was carried out. The study included 307 under-five children from a rural area of western Maharashtra. Information was collected on pretested semi-structured questionnaire after taking informed consent. The anthropological measurements were taken by standard methods. The statistical tests were performed and 5% level significance was taken for analysis. **Statistical Analysis Used:** Data were analyzed using software: WHO Anthro3.2.2, SPSS 26, and Epi Info v7.2.4.0. **Results:** More than half of the under-five children (56.3%) were found to be undernourished. The prevalence of underweight, stunting, and wasting was found to be 33.5%, 35.5%, and 12.4%, respectively. Logistic regression performed showed prelacteal feed, colostrum, BPL cardholder status, and per capita income to be significantly associated with undernutrition. **Conclusions:** Undernutrition still persists to be a major public health concern in rural areas. Most of the determinants of undernutrition are modifiable. The preventive and remedial measures should be an ongoing process to combat this problem.

**KEYWORDS:** *Children, rural, under five, undernutrition*

## INTRODUCTION

Undernutrition among children is a global issue. Most of the children who have undernutrition belong to developing countries.[1] According to the global report 2020, almost a quarter of under-five children are stunted.[2] In India, especially in rural areas, it remains a major public health problem.

Undernutrition has devastating effects and sometimes it may be irreversible too as in the case of stunting. The contributing factors for undernutrition may differ from one region to another. Nutrition plays an essential role in the growth and development of an individual, especially in children and adolescents, because these are periods of rapid growth. Undernutrition not only affects a person physically but also causes an impact on intelligence and emotional quotient.

Ongoing monitoring of the nutritional status in the community is a necessity, since the prevalence of malnutrition and the factors affecting it may change from time to time and place to place. There are few studies on children in rural western Maharashtra, therefore, this study was carried out with the objectives of finding out the prevalence of undernutrition and its association with various demographic and social risk factors.

## SUBJECTS AND METHODS

### Study design

A cross-sectional study was conducted among under-five children in the rural field practice area of a medical college of western Maharashtra.

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### Sample Size:

The minimum sample size of 257 was calculated by WinPepi v11.38 software.[3] taking the prevalence of undernutrition to be 40% (a study by Purohit *et al.*)[4] with an allowable error of 6% and at a significance level of 5%. Finally, 307 participants were included in the study. The ethical clearance from the Institutional Ethics Committee was obtained before conducting the study.

### Study Population:

Out of a total of 15 Anganwadi centers in rural field practice areas of the medical college, three were selected by simple random sampling for our study.

### Inclusion Criteria:

For the study, all the children below 5 years living around the selected Anganwadi centers were included. Exclusion criteria: Under-five children with comorbidities such as congenital heart disease, chronic heart disease, cerebral palsy, and those not willing to participate were excluded from the study.

### Method of data collection:

Written informed consent was obtained from either of the parents. House-to-house surveys were conducted and response was noted on a semi-structured questionnaire.

### Anthropometric measurements:

Anthropometric measurements were taken as per standard guidelines.[5] For children <2 years of age, height was measured using an infantometer. For children more than 2 years of age, the child was measured by making him stand against a wall on which a measuring scale is inscribed. Weight was measured in kg using a weighing scale.

### Study Period:

The study was conducted between September 1, 2018, and September 30, 2020. A pilot study was conducted on 30 children.

### Standards Used:

The weight and height measurement of the children was used to calculate weight for age and height for age using WHO standards.[6] The children were grouped using standard

deviation classification for the international comparison.

The children were classified as:

- Underweight – Z scores <−2 SD for weight for age (W/A)
- Stunted – Z scores <−2 SD for height for age (H/A)
- Wasted – Z scores <−2 SD for weight for height (W/H).

Children were considered to be undernourished if they were either underweight or stunted or wasted.

### Data analysis

Analysis was done by using WHO Anthro,[7] Epi 7.2.4.0,[8] and IBM SPSS Statistics version 26.[9] Quantitative measures were summarized using means and standard deviation. Qualitative measures were summarized using proportion and 95% confidence limits wherever applicable. The quantitative data were explored for normality using Shapiro–Wilk test. Appropriate tests for statistical significance such as *t*-test, Chi-square, or other nonparametric equivalents such as Mann–Whitne were used. The *P* value was taken to be significant

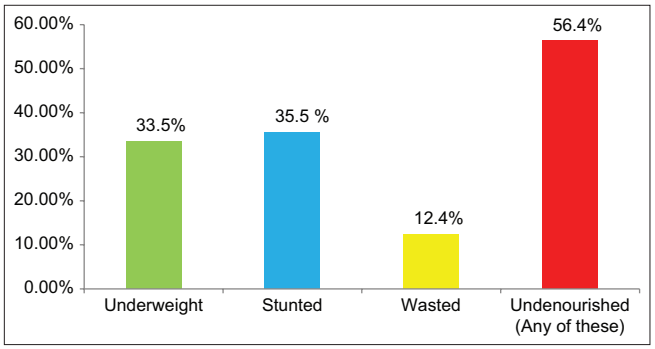


**Figure 1:** prevalence of undernutrition in study population

**Table 1: Distribution of sociodemographic variables of study population**

| | *n* (%) |
|---|---|
| Age groups (months) | |
| 0-6 | 11 (3.6) |
| 6-12 | 59 (19.2) |
| 12-24 | 75 (24.4) |
| 24-60 | 162 (52.8) |
| Number of family members | |
| 3 | 88 (28.7) |
| 4-5 | 127 (41.3) |
| 6-7 | 53 (17.3) |
| >8 | 39 (12.7) |
| Type of family | |
| Nuclear | 203 (66.1) |
| Joint | 85 (27.7) |
| Extended | 19 (6.2) |
| Gender | |
| Boys | 116 (37.8) |
| Girls | 191 (61.2) |
| Religion | |
| Hindu | 215 (70) |
| Muslim | 16 (5.2) |
| Others | 76 (24.8) |
| BPL cardholder | |
| Yes | 246 (80.1) |
| No | 61 (19.9) |
| Total | 307 (100) |

BPL: Below poverty line

when <0.05. Logistic regression was performed on those variables found to have $P < 0.1$ in univariate analysis. The "Enter" method was used.

## Results

A total of 307 under-five children were included in the study. The study population had 191 girls (61.2%) and 116 boys (37.8%) [Table 1].

In this study, around 35.5% (95% confidence interval [CI]: 30.3–41.0) of the children were stunted, 33.5% (95% CI: 28.5–39.01) were underweight, and 12.4% (95% CI: 9.1–16.5) were wasted [Figure 1].

A significantly greater proportion (74.1%) of undernutrition was found among children of large families, BPL cardholders (62.6%), those given prelacteal feeds (78.3%), not given colostrum at birth (72.2%),

**Table 2: Univariate analysis of association of undernutrition with certain variables**

| Variable | Undernourished, *n* (%) | Normal, *n* (%) | OR (95% CI) | Test of significance and *P* |
|---|---|---|---|---|
| Number of family members | | | | *χ2 = Chi Square* 0.07 |
| 3 | 51 (58.0) | 37 (42.0) | 1.00 | |
| 4-5 | 67 (52.8) | 60 (47.2) | 0.81 (0.47-1.40) | |
| 6-7 | 26 (49.0) | 27 (51.0) | 0.70 (0.35-1.39) | |
| 8 and above | 29 (74.3) | 10 (25.7) | 2.10 (0.91-4.85) | |
| Per capita income | | | | |
| <2000 | 55 (77.5) | 16 (22.5) | 8.69 (3.94-19.17) | $\chi^2_{LT}$=30.03 |
| 2001-2500 | 37 (60.7) | 24 (39.3) | 3.90 (1.82-8.35) | <0.001 |
| 2501-3333 | 37 (58.7) | 26 (41.3) | 3.60 (1.70-7.64) | |
| 3334-4667 | 27 (51.9) | 25 (48.1) | 2.73 (1.25-5.97) | |
| >4667 | 17 (28.3) | 43 (71.7) | 1.0 (reference category) | |
| BPL cardholder | | | | |
| Yes | 154 (62.6) | 92 (37.4) | 3.7 (2.03-6.7) | $\chi^2$=18.4 |
| No | 19 (31.1) | 42 (68.8) | | <0.001 |
| Father's education | | | | |
| Illiterate | 23 (62.1) | 14 (37.9) | 0.46 (0.85-2.59) | $\chi^2_{LT}$=4.42 |
| Primary | 25 (65.8) | 13 (34.2) | 0.48 (0.09-2.60) | 0.035 |
| Secondary | 32 (66.7) | 16 (33.3) | 0.57 (0.11-3.07) | |
| Higher secondary | 63 (53.9) | 54 (46.1) | 0.33 (0.07-1.67) | |
| Graduate | 23 (39.7) | 35 (60.3) | 0.19 (0.04-0.98) | |
| Postgraduate | 7 (77.8) | 2 (22.2) | 1 (reference category) | |
| BMI | | | | |
| Mean | 22.7 | 24.4 | | *Mann-Whitney U-test=* 4.8 |
| SD | 3.66 | 3.95 | | <0.001 |
| Median | 22.0 | 24.2 | | |
| Prelacteal feed | | | | |
| Given | 112 (78.3) | 31 (31.7) | 6.1 (3.6-10.1) | $\chi^2$=50.8 |
| Not given | 61 (37.2) | 103 (62.8) | | <0.001 |
| Colostrum at birth | | | | |
| Given | 95 (47.8) | 104 (52.2) | 0.35 (0.21-0.58) | $\chi^2$=16.8 |
| Not given | 78 (72.2) | 30 (27.8) | | <0.001 |
| ICDS beneficiary | | | | |
| Yes | 115 (61.1) | 73 (38.9) | 1.65 (1.04-2.63) | $\chi^2$=4.08 |
| No | 58 (48.8) | 61 (51.2) | | 0.043 |
| Immunization status | | | | |
| Complete | 102 (47.9) | 111 (52.1) | 0.29 (0.17-0.5) | $\chi^2$=19.15 |
| Incomplete | 71 (75.5) | 23 (24.4) | | <0.001 |
| ANC visit | | | | |
| 3-5 | 103 (60.9) | 66 (39.1) | 1 | $\chi^2_{LT}$=3.92 |
| 6-8 | 45 (53.6) | 39 (46.4) | 0.74 (0.44-1.25) | 0.047 |
| ≥9 | 25 (46.3) | 29 (53.7) | 0.55 (0.30-1.02) | |

$\chi^2_{LT}$: Chi-square linear trend, ANC: Antenatal care, ICDS: Integrated Child Development Services, BMI: Body mass index, BPL: Below poverty line, CI: Confidence interval, OR: Odds ratio

**Table 3: Binary logistic regression**

| Variable | *B* | df | *P* | EXP (B) | 95% CI for EXP (B) | |
|---|---|---|---|---|---|---|
| | | | | | Lower | Upper |
| Education of father* | | 5 | 0.19 | | | |
| Illiterate | −2.19 | 1 | 0.08 | 0.11 | 0.009 | 1.35 |
| Primary | −1.59 | 1 | 0.21 | 0.20 | 0.01 | 2.36 |
| Secondary | −0.93 | 1 | 0.44 | 0.39 | 0.03 | 4.28 |
| Higher secondary | −1.83 | 1 | 0.12 | 0.16 | 0.01 | 1.67 |
| Graduate | −1.65 | 1 | 0.16 | 0.19 | 0.018 | 2.01 |
| BPL | 1.242 | 1 | 0.002 | 3.46 | 1.59 | 7.50 |
| Per capita income** | | 4 | 0.008 | | | |
| <2000 | 2.18 | 1 | 0.000 | 8.89 | 2.77 | 28.51 |
| 2001-2500 | 1.38 | 1 | 0.007 | 4.00 | 1.45 | 11.04 |
| 2501-3333 | 1.15 | 1 | 0.019 | 3.18 | 1.20 | 8.39 |
| 3334-4667 | 0.898 | 1 | 0.077 | 2.45 | 0.90 | 6.64 |
| Mother's BMI | −0.068 | 1 | 0.073 | 0.93 | 0.86 | 1.00 |
| Prelacteal feed given | 1.63 | 1 | 0.000 | 5.11 | 2.67 | 9.79 |
| Colostrum given | −0.46 | 1 | 0.18 | 0.62 | 0.31 | 1.24 |
| ICDS beneficiary | 0.69 | 1 | 0.04 | 1.99 | 1.02 | 3.89 |
| Weaning | −0.29 | 1 | 0.32 | 0.74 | 0.41 | 1.34 |
| History of illness | 0.25 | 1 | 0.46 | 1.29 | 0.65 | 2.55 |
| Antenatal visits*** | | 2 | 0.87 | | | |
| 6-8 | −0.23 | 1 | 0.61 | 0.79 | 0.32 | 1.94 |
| ≥9 | −0.10 | 1 | 0.81 | 0.89 | 0.36 | 2.22 |
| Immunization status | −0.652 | 1 | 0.073 | 0.51 | 0.255 | 1.05 |
| Family size**** | | 3 | 0.34 | | | |
| Family size: 3 members | 0.42 | 1 | 0.49 | 1.52 | 0.45 | 5.07 |
| Family size: 4-5 members | 0.07 | 1 | 0.90 | 1.07 | 0.34 | 3.32 |
| Family size: 6-7 members | −0.43 | 1 | 0.45 | 0.64 | 0.20 | 2.04 |
| Constant | 1.14 | 1 | 0.522 | 3.15 | | |

*Education of father: Postgraduate was taken as reference value, **Quintiles: >4667 was taken as reference value, ***ANC: >8 visits were taken as reference value, ****Family size 8 and above was taken as reference value. ANC: Antenatal care, ICDS: Integrated Child Development Services, BMI: Body mass index, BPL: Below poverty line, CI: Confidence interval

with incomplete immunization status (75.5%), and with less number of Antenatal (ANC) visits (3–5 visits, 60.9%). There was a significant increasing trend of undernutrition with decreasing income. Undernutrition was low in children whose paternal education was graduate (39.7%) and higher secondary (53.9%) and highest among postgraduates (77.8%), but their numbers were few. Integrated child development scheme (ICDS) beneficiaries had higher undernutrition (61.1%). Undernourished children had a significantly lower median maternal body mass index (BMI) (22) as compared to normal children (24.2) [Tables 2 and 3].

The risk factors, such as age, gender, religion, birth weight, birth order, type of family, mother's education, mother's BMI, exclusive breastfeeding, weaning, and history of illness, were found to be statistically insignificant.

The logistic regression analysis was performed on determinants identified as risk factors with $P < 0.1$. These were per capita income, BPL cardholder, father's educational status, mother's BMI, prelacteal feed, colostrum, ICDS beneficiary, immunization status, history of illness, ANC visits, and family size. The model could correctly predict 75.9% of the nutrition category.

BPL cardholder status, per capita income, prelacteal feed, and ICDS beneficiary were found to be statistically significant.

## Discussion

Undernutrition was found to be prevalent in 56.4% of the population. 33.5% of the children were underweight, 35.5% were stunted, and 12.4 were wasting. These statistics are nearly identical to Maharashtra's NFHS-5 findings, which show 36.1%, 35.2%, and 25.6%, respectively.[10] In western Maharashtra, a study by Khadse and Chaurasia indicated that the prevalence of underweight was 38%, stunting was 38%, and wasting was 28%.[11]

A study from western Maharashtra by Murarkar *et al*, it was found that 35.4% children were underweight,

17% had wasting and 45.9% were stunted.[12] Purohit *et al*. reported that among children under the age of 5, the prevalence of underweight, stunting, and wasting was 38%, 40%, and 16%, respectively, in another Maharashtra study.[4] In a study by Dabar *et al*., 34.0% of the children were underweight, while 42.6% were stunted.[13]

Family size was found to have a direct link with undernutrition in the current study. The prevalence of undernutrition rises as the size of the family grows (members >8). Sharma *et al*. overcrowded families.[14] Undernourishment was reported to be higher (77.5%) among the lower socioeconomic class in the current study. Ghimire *et al*. also had similar findings in their study.[15] Choudhary *et al*. found no link between undernutrition and the size of one's family.[16] A larger family means that household income is distributed fairly. More family members burden the household, resulting in a reduction in the availability of optimal nutritional foods for adults and children.

In our study, families with a below poverty line card showed a higher prevalence of undernutrition (62.6%) (BPL card). Dabar *et al*. discovered similar results.[13] People with a BPL card have a poor income and may not be able to meet their necessities, as is well documented.

In this study, the likelihood of undernutrition increased as the education of the fathers declined. Children with fathers who were graduates had the lowest rate of undernutrition (51.5%), while children with fathers who were illiterate and children with fathers who were educated up to primary school had the highest rates of undernutrition (62.1% and 65.8%, respectively). In their investigations, Karkappanavar. (India) and Pravana *et al*. (Nepal) reported comparable results.[17,18] A well-educated father can become a more reliable source of income for the family, besides inculcating healthy habits.

Mothers with children who were malnourished had a much lower BMI. Talukder in Bangladesh observed that a mother's BMI had a substantial negative effect on child malnutrition, implying that healthier mothers were less likely to have undernourished children.[19] Tigga and Sen found similar results.[20] The nutritional status of the mother has an impact on the nutritional status of the kid. A malnourished mother gives birth to a low-birth-weight baby, perpetuating the malnutrition cycle through the generations. The dietary deficiency may persist throughout childhood and adulthood.

Undernutrition was shown to be higher (78.3%) in children who were given prelacteal feeds, compared to 37.2% in children who were not given prelacteal feeds in the current study. In their research, Nayak *et al*. and Choudhary *et al*. also observed similar results.[16,21] Prelacteal feeds are the first foods given to a baby after birth. Honey, sugar water, and jaggery water are the most common feeds. In a neonate, the gastrointestinal system is not well developed enough to handle foreign meals. It could result in infection and growth retardation.

In this study, it was discovered that children who were not fed colostrum had a higher likelihood of being malnourished (72.2%). Oljira. observed that such children experienced higher wasting.[22] Colostrum is thick yellow milk secreted by the mother in the first 2–3 days postpartum. It is well known that it is dense in antibodies and immunoglobulins, which aid in the development of a child's immune system. If a child is deprived of colostrum, he or she may be missing early important nutrients that may not be available later in life. A child with a weak immune system is vulnerable to a variety of illnesses, which can lead to malnourishment.

In the current study, we discovered that children who were ICDS beneficiaries had a greater percentage (61.1%) of undernutrition. On the contrary, Gragnolati *et al*. found that children who were ICDS beneficiaries had lower rates of undernutrition than children who were not.[23] Thakur *et al*. reported no effect of enrollment.[24] A reason for the aforesaid finding could be that children who are registered under ICDS are not taking advantage of the services that are available.

The link between a child's vaccination status and undernutrition was determined to be statistically significant. Those who were partially immunized were found to be undernourished as compared to children who were fully immunized in the current study. Immunization was found to protect children from malnutrition when they were fully immunized in a Mumbai slum by Khadse and Chaurasia.[11] Immunization has long been thought to have a protective role. It protects children from illnesses such as diarrhea, measles, and acute respiratory infections.

In this study, children with a history of illness had a greater rate of undernutrition (63.5%) than children without a history of illness (52.5%). In a study in Maharashtra, Tiwari *et al*. made similar observations as did Singh.[25,26] Infection in a child causes a short-term growth lag, but if ignored after the acute episode of illness, the growth lag can persist.

The current study discovered that the chances of being undernourished decreased as the number of antenatal visits grew. Khan *et al*. found similar results.[27] Stunting was also less likely in children whose mothers received >4 antenatal visits throughout pregnancy,

according to Syeda *et al*.[28] A pregnant woman's frequent visits to the hospital for antenatal care ensure that her ailments are treated promptly. Mothers are taught about exclusive breastfeeding and the importance of newborn care during antenatal sessions. It is also possible that women who attend ANC regularly are more health conscious and are more likely to take better care of themselves and their children, resulting in fewer children suffering from malnutrition.

## Conclusion:

The present study revealed that nearly 56.35% children were suffereing from one or the other forms of undernutrition (Underweight/Stunting/Wasting).The univariate analysis revealed that family size, Per capita income, BPL card holder status, father's education, mother's BMI, pre lacteal feed, giving colostrum, weaning practices, ICDS beneficiary ,Immunization status and Mothers ANC visits were statistically significantly($p<0.05$) associated with undernutrition. When the confounders were adjusted by performing logistic regression analysis, it was found that BPL card holder status ICDS beneficiary status, per capita income and pre lacteal feed were found to be significantly associated with undernutrition.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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