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# Socio-economic determinants of underweight children in West Bengal, India

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ABSTRACT

**Objective:** To study the extent of undernutrition at district level and the socio-economic determinants of underweight children aged 0-71 months in West Bengal. **Methods:** The data were accessed from the Reproductive and Child Health Survey (RCHS-II), which contained information of 7 550 children and their parents. Information of socio-economic variables about the associated families of these children had also been taken for our study. This study computed weight-for-age z-scores to assess the nutritional status of the children using WHO (2006) reference. **Results:** The prevalence of underweight varied over the districts. Districts with very high prevalence of underweight children were Murshidabad, Burdwan, Purulia, Medinipur, Howrah and South 24 Parganas. High prevalent districts for both boys and girls were Jalpaiguri and Coochbihar. Low prevalent districts for both boys and girls were South Dinajpur, Nadia and Kolkata. The percentage of underweight children were more in rural areas among Muslim families with illiterate parents and low standard of living. In Murshidabad, Bankura, Nadia, Medinipur and South 24 Parganas districts, i.e., where prevalence of underweight children were higher, the rural and urban differences were less. The characteristics like religion, parents´ educational status and standard of living index showed significant effect on the children´s weights. **Conclusions:** Public intervention programs on the parent´s education and the standard of living of the households at district level should be given high priority to combat the children´s undernutrition problems so far as weight for age is concerned.

## 1. Introduction

Nutritional status of pre-school children is a sensitive indicator of community health and nutrition[1]. Undernutrition leads to failure of immune system[2]. An imbalance in dietary intake and/or attack of infectious diseases may cause poor nutritional status[3-5]. Nutritional status also depends on environmental and socioeconomic factors such as household socio-economic status (SES), maternal education, household hygiene, and health services[6]. Not all variables are equally important in determining whether a baby is underweight, or suffering from acute or chronic malnutrition[7]. Low food intake is one of the main causes of undernutrition and growth retardation (stunting) in early childhood specifically of pre-school children among poor households[8]. It is accepted world-wide that height and weight, the two anthropometric parameters, are relevant indicators for assessing the status of nutrition especially among children[9,10].

Undernutrition of children in India still remains a major public health problem even after the largest food supplementation programs for children introduced through Integrated Child Development Service (ICDS) and mid-day meal programs. The problem aggravates due to poor child feeding practices and poor access to health care system[11]. Over the last three decades, poverty and mortality rates have come down by 50% and fertility rate by 40%. However, reduction in undernutrition in children was only 20%[12]. One of the causes behind these situations might be lack of documentation and organizational implementation of nutritional intervention programs at regional level or local administrative or district level. As a result, some districts suffer more compared to others. Prevalence of stunting were 53% in the drought-affected desert district of western Rajasthan. The percentages of underweight and wasted

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children were 60% and 28%, respectively in that area[13].

India is a vast country with varied culture and habits. However, in all States, there is substantial urban-rural and inter-district variation in the Human Development Index (HDI). There has been an apparent increase in the prevalence of undernutrition over time in rural India, while in urban areas, the prevalence has remained unchanged, or has declined[14] .

The population of West Bengal is about 82 million[15]. 72% of these people live in rural areas. In rural areas, concentration of Scheduled Caste and Scheduled Tribe people are 28.6% and 19.9%, respectively whereas these percentages in urban areas are 5.8% and 1.5%, respectively. Muslims are the dominant group among the minorities, accounting for 33.3% in the urban and 11.8% in the rural areas[16]. According to the Planning Commission[17], the percentage of population below poverty line was 27.02%. These percentages in rural and urban areas are 31.85% and 14.86%, respectively[18]. In West Bengal, Infant mortality rate is 38%, under-five mortality rate is 67.6%, and life expectancy is 65 years for male and 64 years for female. There are some districts such as Malda, Coochbihar, Birbhum and Murshidabad, where the life expectancies are below 60.

The national level programme for eradicating undernutrition problem in India is implemented at district level, which is designated as a local administrative unit. Therefore, the prevalence and determinants of undernutrition may vary district-wise, which has been seen in this study. This phenomenon may be valuable inputs for understanding of undernutrition problem in other developing countries, where such programmes are to be taken at decentralized level.

The main objectives of the present study are to see the nutritional status based on weight for age index of under-six children (0-71 months) and its variations over the districts of West Bengal, to study the variation of nutritional status based on weight for age index in respect of certain socio-economic variables such as gender, place of residence (rural and urban), religion, level of education of parents and standard of living index of the households and to analyse the socio-economic factors behind the regional i.e., district-wise and place of residence wise variation of the nutritional levels of the under-six children in the state of West Bengal.

## 2. Materials and methods

The data on growth and nutritional status of children have been taken from Reproductive and Child Health Survey (RCHS-II) conducted in March, 2002[19]. The survey was coordinated by International Institute for Population Sciences (IIPS) in collaboration with Ministry of Health and Family Welfare. Out of total sample of 8 932 children aged 0-71 months, this study contained only 7 550 children with proper information about their parents and other socio-economic variables. Age was assessed through the record of date of birth in the format dd/mm/yy where dd means the two digited date, mm means the digited months starting from 00 to 12 and yy means last two digits of years.

There was no data on heights of the children. Thus Weight for height or Height for age could not be computed.

For computing the "Z" score of each child, the reference of "weight for age" was followed according to WHO, 2006 for 0-60 months[20] and WHO, 2007 for 61-71 months[21], respectively.

Z-score was defined as the deviation of the value observed for an individual from the median of the reference population, divided by the standard deviation (SD) of the reference population i.e.

$$\text{Z-score} = \frac{(\text{observed value}) - (\text{median of the reference population})}{\text{SD of the reference population}}$$

The classifications of Z-score were "below normal" (< -2SD), "normal" (-2SD to + 2SD) and "above hormal" (≥+ 2SD) [22].

The covariates were sex of the children, place of residence such as rural/urban, religion, parent´s educational status and standard of living index. To present the relative and effective intervention, the risk of Z-score value for underweight was regressed on socio-economic variables using binary logistic regression analysis. Both dependent and independent variables were taken as binary when weight for age (WAZ) is controlled by age and sex. Elimination WAZ by age and sex leads to some complications. If we eliminate WAZ by age and sex then the new adjusted WAZ can´t be transformed in to dummy binary variable as it is done with the usual WAZ values where standard cut-off points are defined and are available in literature (i.e., WAZ < - 2SD implies below normal, and so on). Instead, what we have done is that we have regressed WAZ binary variables on age, sex and associated variables. This process automatically takes care of the problem of elimination of the effect of age and sex.

## 3. Results

Table 1 clearly showed the steady increase in the mean weight (kg) of the under-six children along with the age for both the boys and girls. Percentage of underweight children first increased up to 36 months for both the boys and girls, then decreased to about 60 months. After that it increased again for boys, but after 36 months, in case of girl children the trend was in zigzag pattern. The data revealed that percentage of underweight children was 29.0% and 26.0% for both the boys and girls, respectively.

District-wise arithmetic mean and SD as well as its adjusted mean (after eliminating the effect of age) and rank among the under-six children by sex were given in Table 2. According to rank of adjusted mean weight for boys and girls, Medinipur district had the lowest rank and Kolkata district had the highest. Table 2 also showed the variation in the percentages of underweight children in West Bengal for all the eighteen districts. The percentage ranged from 14.0% to 37.0%. These percentages were divided into four categories as low (14%-20%), moderate (21%-25%), high (26%-30%) and very high (31%-40%). Undernourished districts with very high prevalence for both boys and girls were observed in Murshidabad, Burdwan, Purulia, Medinipur Howrah and South 24 Parganas. High prevalent districts for both sexes were Jalpaiguri and Coochbihar. Low prevalent districts for both sexes were South Dinajpur, Nadia and Kolkata. The magnitudes of differences between boys and girls were remarkably high in some districts such as Uttar Dinajpur, Birbhum and Nadia, and girls were always in a better condition than boys. Kolkata had the lowest frequency of underweight children. However, there was a problem of obesity in Kolkata. The problem of obesity had also been found in Bankura district for both boys and girls. There was a double burden as undernutrition and obesity for boys in this district. To some extent, the double burden also had been observed for girls in Murshidabad district.

Children with better health were usually found in households with high standard of living and with high parents´ education (Table 3). It was also noted that the girl

**Table 1**

Age and sex wise mean weight (kg) and nutritional status of under- six children in West Bengal.

| | Age-group (months) | *n* | Weight (kg, mean±SD) | Normal (%,-2SD to +2SD) | Undernutrition(%) | | Overweight (%, ≥ + 2SD) |
|---|---|---|---|---|---|---|---|
| | | | | | Moderate (-3SD to -2SD) | Severe(<-3SD) | |
| Boys | 0 – 3 | 118 | 4.42±1.21 | 72.90 | 11.00 | 2.50 | 13.60 |
| | 3 – 6 | 143 | 6.39±1.16 | 81.80 | 9.80 | 8.40 | 0.00 |
| | 6 – 9 | 174 | 7.30±1.09 | 78.70 | 16.10 | 4.60 | 0.60 |
| | 9 – 12 | 171 | 7.96±1.23 | 74.90 | 17.50 | 7.60 | 0.00 |
| | 12 – 24 | 652 | 8.96±1.47 | 66.40 | 25.90 | 6.70 | 1.00 |
| | 24 – 36 | 621 | 10.77±1.64 | 64.40 | 30.40 | 4.80 | 0.40 |
| | 36 – 48 | 633 | 12.27±1.68 | 69.40 | 28.00 | 2.60 | 0.00 |
| | 48 – 60 | 688 | 13.85±1.83 | 73.80 | 24.60 | 1.60 | 0.00 |
| | 60 – 71 | 680 | 15.24±2.06 | 70.40 | 27.40 | 2.20 | 0.00 |
| | Total | 3 880 | 11.40±3.36 | 70.30 | 25.10 | 3.90 | 0.70 |
| Girls | 0 – 3 | 126 | 4.34±1.11 | 72.20 | 6.30 | 3.20 | 18.30 |
| | 3 – 6 | 153 | 6.03±1.06 | 88.90 | 7.80 | 2.60 | 0.70 |
| | 6 – 9 | 155 | 6.85±1.16 | 81.90 | 13.50 | 1.30 | 3.30 |
| | 9 – 12 | 129 | 7.28±0.99 | 77.50 | 20.90 | 1.60 | 0.00 |
| | 12 – 24 | 597 | 8.41±1.42 | 74.90 | 20.90 | 3.40 | 0.80 |
| | 24 – 36 | 646 | 10.10±1.60 | 67.20 | 27.40 | 4.60 | 0.80 |
| | 36 – 48 | 662 | 11.88±1.66 | 73.70 | 26.00 | 0.30 | 0.00 |
| | 48 – 60 | 589 | 13.30±1.81 | 71.80 | 28.20 | 0.00 | 0.00 |
| | 60 – 71 | 613 | 14.64±2.15 | 69.80 | 30.20 | 0.00 | 0.00 |
| | Total | 3 670 | 10.80±3.30 | 72.90 | 24.30 | 1.70 | 1.10 |

**Table 2**

District-wise mean weight (kg), adjusted mean (after eliminating the effect of age,), rank and nutritional status of under-six children.

| | District | *n* | Weight (kg, mean ± SD) | Adjusted mean | Rank | Normal (%, -2SD to 2SD) | Malnourish (%, <-2SD) | Overweight (%, ≥2SD) |
|---|---|---|---|---|---|---|---|---|
| Boys | Darjeeling | 217 | 11.63±3.44 | 11.56 | 12 | 75.60 | 24.00 | 0.40 |
| | Jalpaiguri | 267 | 11.20±3.36 | 11.40 | 10 | 69.30 | 29.60 | 1.10 |
| | Coochbihar | 291 | 10.91±3.45 | 11.15 | 2 | 69.80 | 29.60 | 0.60 |
| | North Dinajpur | 164 | 11.57±3.14 | 11.55 | 11 | 67.70 | 31.10 | 1.20 |
| | South Dinajpur | 205 | 12.06±3.36 | 11.92 | 17 | 81.00 | 18.00 | 1.00 |
| | Malda | 282 | 11.86±3.45 | 11.67 | 14 | 77.30 | 22.00 | 0.70 |
| | Murshidabad | 278 | 10.97±3.50 | 11.25 | 4 | 64.40 | 35.30 | 0.30 |
| | Birbhum | 262 | 11.69±3.28 | 11.38 | 9 | 71.40 | 28.20 | 0.40 |
| | Burdwan | 231 | 11.43±3.24 | 11.25 | 3 | 64.90 | 35.10 | 0.00 |
| | Nadia | 150 | 12.21±3.08 | 11.84 | 15 | 81.30 | 18.00 | 0.70 |
| | North 24 Parganas | 200 | 11.23±3.44 | 11.32 | 7 | 68.50 | 31.00 | 0.50 |
| | Hooghly | 154 | 12.35±3.01 | 11.85 | 16 | 74.70 | 24.70 | 0.60 |
| | Bankura | 194 | 11.29±3.49 | 11.29 | 5 | 67.50 | 30.40 | 2.10 |
| | Purulia | 232 | 11.29±3.39 | 11.29 | 6 | 67.70 | 31.90 | 0.40 |
| | Medinipur | 239 | 10.89±3.24 | 11.03 | 1 | 62.30 | 37.70 | 0.00 |
| | Howrah | 178 | 11.19±3.58 | 11.35 | 8 | 67.40 | 32.60 | 0.00 |
| | Kolkata | 97 | 11.77±3.46 | 12.11 | 18 | 82.50 | 15.50 | 2.00 |
| | South 24 Parganas | 239 | 10.77±3.09 | 11.56 | 13 | 64.00 | 35.60 | 0.40 |
| | West Bengal | 3 880 | 11.41±3.37 | – | – | 70.30 | 29.10 | 0.60 |
| Girls | Darjeeling | 180 | 10.60±3.49 | 11.02 | 13 | 72.80 | 26.10 | 1.10 |
| | Jalpaiguri | 246 | 10.73±2.96 | 10.70 | 8 | 74.00 | 25.60 | 0.40 |
| | Coochbihar | 256 | 10.51±3.14 | 10.64 | 6 | 71.90 | 28.10 | – |
| | North Dinajpur | 145 | 10.60±3.22 | 10.83 | 9 | 76.60 | 22.80 | 0.60 |
| | South Dinajpur | 193 | 11.52±3.18 | 11.34 | 17 | 84.50 | 14.00 | 1.50 |
| | Malda | 296 | 11.09±3.32 | 10.96 | 11 | 80.10 | 18.90 | 1.00 |
| | Murshidabad | 252 | 10.54±3.29 | 10.57 | 4 | 61.90 | 36.10 | 2.00 |
| | Birbhum | 240 | 10.88±3.16 | 10.97 | 12 | 76.30 | 21.30 | 2.40 |
| | Burdwan | 194 | 10.61±3.11 | 10.45 | 2 | 62.90 | 37.10 | 0.00 |
| | Nadia | 142 | 11.90±3.01 | 11.31 | 16 | 85.20 | 14.80 | 0.00 |
| | North 24 Parganas | 186 | 10.46±3.46 | 10.83 | 10 | 72.00 | 28.00 | 0.00 |
| | Hooghly | 130 | 11.55±3.12 | 11.27 | 15 | 83.10 | 16.20 | 0.70 |
| | Bankura | 189 | 11.26±3.48 | 11.08 | 14 | 72.00 | 23.80 | 4.20 |
| | Purulia | 219 | 10.60±3.49 | 10.66 | 7 | 68.00 | 30.60 | 1.40 |
| | Medinipur | 252 | 10.17±3.33 | 10.21 | 1 | 63.10 | 36.50 | 0.40 |
| | Howrah | 176 | 10.48±3.61 | 10.54 | 3 | 68.20 | 31.30 | 0.50 |
| | Kolkata | 94 | 11.61±3.73 | 11.72 | 18 | 86.20 | 10.60 | 3.20 |
| | South 24 Parganas | 280 | 10.71±3.19 | 10.58 | 5 | 70.40 | 29.30 | 0.30 |
| | West Bengal | 3 670 | 10.81±3.30 | – | – | 72.90 | 26.10 | 1.00 |

children with age of 0–6 yrs showed better health status than boys. Differences of underweight children between rural and urban areas were not so marked as in the other socio–economic variables. High percentage of underweight children had been found among Hindu and Muslim families. Christians and others comprising mostly Sikhs, Jains and Parsis were least affected. It was well known that mothers´ education had positive influence on the health and nutritional status of the children, and fathers´ education was also reckoned in this respect. Percentage of underweight children of literate father was 24.0%, which was slightly higher than percentage of underweight children of literate mother (21.0%).

**Table 3**
Socio–economic variables for underweight children [*n*(%)].

| Variables | | Underweight |
|---|---|---|
| Sex of the child | Male | 3 880(29.1) |
| | Female | 3 670(26.1)* |
| Type of place | Rural | 5 703(19.7) |
| | Urban | 1 847(21.2) |
| Religion | Hindu | 5 147(26.2) |
| | Muslim | 2 284(31.1)* |
| | Christian | 66(24.2) |
| | Others | 53(13.2)* |
| Mother´s education | Illiterate | 3 442(34.4) |
| | Literate | 4 108(21.0)* |
| Father´s education | Illiterate | 2 665(34.3) |
| | Literate | 4 885(24.0)* |
| Standard of living index | Low | 4 887(32.4) |
| | Middle | 1 909(22.1)* |
| | High | 764(10.6)* |

* Significant at 1% level.

Table 4 described the distribution of underweight children with respect to different socio–economic variables in different districts of West Bengal. Kolkata´s position was far better than the districts like Murshidabad, Malda, Coochbihar, Medinipur etc. Concentration of undernutrition was high among children in rural areas and Muslim families with illiterate parents and with low standard of living.

The binary variables of the z–scores of weight for age were subjected to binary logistic regression in order to get the determinants of underweight children considering the selected socio–economic background of 0–71 months children of West Bengal (Table 5). The regression showed expected result. This result also showed that important intervening characteristics like religion, parent´s educational status and standard of living index had significant effect on the underweight children, but place of residence did not have such significant influence as concerning other variables simultaneously.

Table 6 showed a remarkable percentage of underweight children in families with literate mothers for both Hindu and Muslim religions except for a few districts like Coochbihar. It was also noticed in Coochbihar, Malda, North 24 Parganas and Medinipur districts, that there were not much differences of underweight children between the Hindu and Muslim families regardless the status of literacy of mothers. In those districts religion, literacy of the mothers had little differential impact on the child nutrition. Generally, status of literacy of mothers had great influence on children´s nutritional level. Fathers´ education was also a powerful factor in reducing children´s underweight status, though it was not as pronounced as mothers´ literacy status. It can be computed from Table 5 that changes in the percentage of underweight children in West Bengal due to change in the fathers´ literacy status, fixing mothers´ literacy status separately as illiterate and literate, are 3.2 and 8.5, respectively. The same changes, fixing fathers´ literacy status, are 6.5 and 11.8, respectively.

**Table 4**
District–wise percentage distributions of undernutrition with socio–economic variables [*n*(%)].

| Districts | Residence | | Religion | | Fathers´ education | | Mthers´ education | | Standard of living index | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rural | Urban | Hindu | Muslim | Illiterate | Literate | Illiterate | Literate | Low | Medium | High |
| Darjeeling | 304(27.3) | 93(17.2) | 340(26.2) | 9(55.6) | 91(42.9) | 306(19.6) | 158(34.8) | 239(18.4) | 231(32.0) | 126(16.7) | 40(10.0) |
| Jalpaiguri | 395(30.1) | 118(19.5) | 399(25.3) | 92(37.0) | 205(36.1) | 308(22.1) | 257(40.1) | 256(15.2) | 353(32.9) | 119(21.0) | 41(2.4) |
| Coochbihar | 448(31.3) | 99(18.2) | 342(27.5) | 204(31.4) | 217(30.9) | 330(27.6) | 263(28.5) | 284(29.2) | 433(31.9) | 72(23.6) | 42(7.1) |
| North Dinajpur | 252(29.4) | 57(17.5) | 180(18.3) | 129(39.5) | 160(31.9) | 149(22.1) | 213(32.9) | 96(14.6) | 232(31.5) | 52(13.5) | 25(16.0) |
| South Dinajpur | 327(17.1) | 71(11.3) | 282(16.3) | 116(15.5) | 171(20.5) | 227(12.8) | 172(19.8) | 226(13.3) | 306(18.0) | 66(10.6) | 26(7.7) |
| Malda | 489(21.7) | 89(13.5) | 226(19.5) | 351(21.1) | 312(25.3) | 266(14.7) | 355(25.6) | 223(12.1) | 438(23.7) | 96(12.5) | 44(4.5) |
| Murshidabad | 416(37.0) | 114(30.7) | 247(30.0) | 275(41.1) | 217(44.2) | 313(29.7) | 275(42.2) | 255(28.6) | 371(38.5) | 124(33.9) | 35(11.4) |
| Birbhum | 395(24.3) | 107(27.1) | 334(26.3) | 166(22.3) | 199(30.2) | 303(21.5) | 262(29.4) | 240(20.0) | 364(26.6) | 84(25.0) | 54(13.0) |
| Burdwan | 291(38.5) | 134(30.6) | 301(34.9) | 107(40.2) | 147(49.7) | 278(28.8) | 178(49.4) | 247(26.3) | 249(43.4) | 128(30.5) | 48(12.5) |
| Nadia | 252(16.7) | 40(15.0) | 225(15.6) | 66(19.7) | 131(19.1) | 161(14.3) | 118(18.6) | 174(14.9) | 175(18.9) | 91(13.2) | 26(11.5) |
| North 24 Parganas | 247(35.6) | 139(18.3) | 166(25.9) | 211(32.7) | 93(40.9) | 293(25.9) | 125(37.6) | 261(25.7) | 184(35.3) | 154(27.3) | 48(14.6) |
| Hooghly | 216(24.5) | 68(8.8) | 228(20.6) | 56(21.4) | 63(31.7) | 221(17.6) | 93(31.2) | 191(15.7) | 105(30.5) | 96(19.8) | 83(9.6) |
| Bankura | 278(28.1) | 105(24.8) | 367(27.2) | 16(25.0) | 100(30.0) | 283(26.1) | 173(37.0) | 210(19.0) | 237(32.9) | 110(21.8) | 36(5.6) |
| Purulia | 332(34.3) | 119(22.7) | 399(31.6) | 52(28.8) | 142(39.4) | 309(27.5) | 263(38.0) | 188(21.8) | 312(36.5) | 83(22.9) | 56(14.3) |
| Medinipur | 379(38.8) | 112(31.3) | 391(36.8) | 98(38.8) | 123(44.7) | 368(34.5) | 175(44.0) | 316(33.2) | 341(41.3) | 122(30.3) | 28(14.3) |
| Howrah | 248(37.1) | 106(19.8) | 233(27.0) | 120(41.7) | 90(46.7) | 264(26.9) | 112(48.2) | 242(24.4) | 175(49.1) | 137(15.3) | 42(14.3) |
| Kolkata | – | 191(13.1) | 159(11.3) | 28(25.0) | 24(20.8) | 167(12.0) | 39(17.9) | 152(11.8) | 12(16.7) | 109(15.6) | 70(8.6) |
| South 24 Parganas | 434(32.3) | 85(31.8) | 328(30.8) | 188(34.0) | 180(38.3) | 339(28.9) | 211(36.0) | 308(29.5) | 359(34.3) | 140(28.6) | 20(20.0) |
| West Bengal | 503(29.7) | 147(26.2) | 547(26.2) | 284(31.1) | 265(34.3) | 485(24.0) | 342(34.4) | 408(21.9) | 477(32.4) | 109(22.1) | 764(10.6) |

**Table 5**
District-wise percentage distributions of undernutrition with paternal education [*n*(%)].

| Districts | Both illiterate | Illiterate mother &literate father | Literate mother &illiterate father | Both literate |
|---|---|---|---|---|
| Darjeeling | 78(46.2) | 80(23.8) | 13(23.1) | 226(18.1) |
| Jalpaiguri | 170(38.2) | 87(43.7) | 35(25.7) | 221(13.6) |
| Coochbihar | 171(31.6) | 92(22.8) | 46(28.3) | 238(29.4) |
| North Dinajpur | 147(32.7) | 66(33.2) | 13(23.1) | 83(13.3) |
| South Dinajpur | 127(22.2) | 45(13.3) | 44(15.9) | 182(12.6) |
| Malda | 260(27.3) | 95(21.1) | 52(15.4) | 171(11.1) |
| Murshidabad | 182(44.0) | 93(38.7) | 35(45.7) | 220(25.9) |
| Birbhum | 172(30.2) | 90(27.8) | 27(29.6) | 213(18.8) |
| Burdwan | 104(54.8) | 74(41.9) | 43(37.2) | 204(24.0) |
| Nadia | 87(19.5) | 31(16.1) | 44(18.2) | 130(13.8) |
| North 24 Parganas | 51(43.1) | 74(33.8) | 42(38.1) | 219(23.3) |
| Hooghly | 46(30.4) | 47(31.9) | 17(35.3) | 174(13.8) |
| Bankura | 88(34.1) | 85(40.0) | 12(0.0) | 198(20.2) |
| Purulia | 123(40.7) | 140(35.7) | 19(31.6) | 169(20.7) |
| Medinipur | 94(46.8) | 81(40.7) | 29(37.9) | 287(32.8) |
| Howrah | 54(55.6) | 58(41.4) | 36(33.3) | 206(22.8) |
| South 24 Parganas | 113(37.2) | 98(34.7) | 67(40.3) | 241(26.6) |
| Kolkata | 16(25.0) | 23(13.0) | 8(12.5) | 144(11.8) |

**Table 6**
District-wise percentage distributions of undernutrition with maternal education and religion.

| Districts | Illiterate mother | | Literate mother | |
|---|---|---|---|---|
| | Hindu | Musilim | Hindu | Musilim |
| Darjeeling | 35.2 | 60.0 | 19.7 | 50.0 |
| Jalpaiguri | 39.2 | 43.3 | 13.8 | 25.0 |
| Coochbihar | 26.4 | 31.1 | 28.3 | 31.8 |
| North Dinajpur | 22.4 | 41.7 | 13.4 | 21.4 |
| South Dinajpur | 20.3 | 17.9 | 12.8 | 14.3 |
| Malda | 27.4 | 24.7 | 9.8 | 14.2 |
| Murshidabad | 32.3 | 48.5 | 28.4 | 29.2 |
| Birbhum | 32.9 | 23.2 | 19.8 | 21.1 |
| Burdwan | 51.6 | 45.7 | 22.9 | 36.1 |
| Nadia | 15.0 | 26.3 | 15.9 | 10.7 |
| North 24 Parganas | 36.8 | 39.0 | 22.7 | 28.7 |
| Hooghly | 33.8 | 15.4 | 13.5 | 23.3 |
| Bankura | 38.3 | 18.2 | 18.5 | 40.0 |
| Purulia | 39.5 | 26.7 | 20.5 | 31.8 |
| Medinipur | 43.3 | 46.3 | 33.5 | 33.3 |
| Howrah | 51.8 | 44.6 | 19.2 | 39.1 |
| South 24 Parganas | 33.1 | 39.0 | 29.4 | 30.2 |
| Kolkata | 12.5 | 42.9 | 11.0 | 19.0 |
| West Bengal (No.) | 34.0(734) | 35.2(436) | 20.6(617) | 26.3(275) |

## 4. Discussion

The study provides information about age group-wise and district-wise variation of weight (kg) and weight for age among the under-six children in West Bengal, India. The study also finds the socio-economic variables which affect the status of health of children. For this, it covers 7 550 children of 18 districts of West Bengal using RCHS-2nd round data [19]. The data reveal that in West Bengal, percentage of underweight children among the under-six children is 29.0% and 26.0% for boys and girls, respectively, which are less than the respective India percentages, though there are substantial variations among the different districts.

West Bengal is the fourth populous state in India with the population density as 903, which is much higher than all population density of 324 in India. However, the overall development status of West Bengal, as found from Human Development Index, is in the middle position. There are also substantial variations across the districts. It is as high as 0.78 in Kolkata and as low as 0.44 in Malda. District with high prevalence of underweight children are Murshidabad, Burdwan, Purulia, Medinipur Howrah and South 24 Parganas districts. These districts also have low per capita income. The districts with low prevalence of underweight are South Dinajpur, Nadia and Kolkata. Kolkata is the only district with very low prevalence of underweight children. Differences in the percentage of underweight children between rural and urban areas are not so marked like socio-economic variables. It may be noted here that informal sectors has lead to a substantial growth in rural areas. This has increased the employment opportunity in rural areas of West Bengal[16].

In general, Bivariate and multivariate analyses also show that the educational status of mothers and standard of living of the households have significant influence on minimizing the level of under nutrition in children. But the study also indicates that in some districts like Coochbihar, Birbhum, North 24 Parganas, Hooghly and South 24 Parganas, fathers´ educational level might play a more significant role than mothers´.

Therefore, all the evidences point to the fact that public intervention programs on the parent´s education and the standard of living of the households at district level should be given high priority to combat the children´s undernutrition problems so far as weight for age is concerned.

## Conflict of interest statement

We declare that we have no conflict of interest.

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