Child Health Deprivation based on Anthropometric Indicators: A Case Study of Rural Region in West Bengal

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Abstract

Child deprivation is a universal problem that perseveres both in less developed as well as in developed countries in multidimensional forms. It can be analyzed from different points of view. A child is reckoned as deprived in one or more realms depending on the number and type of deprivation undergoes at different ages of the childhood period. If a child agonizes from the problem of stunting, wasting and underweight, then the country's future growth potential may be retarded and sustainability may recede. In this study importance is given on child deprivation relating to health together with a focus on mother's health status and financial support of the family. Children organize the future human capital for any country. Hence it is considered highly important that their competence be enhanced from early childhood so that their productive contribution to society when they grow up, can accelerate the economic and cultural improvement of an economy. So, children in every society should adore the right to food, shelter, education and healthcare. Hence it is imperative that their health-related issue be attended with great care and apprehension. There is a high connotation between children' physical growth and its determinants. In this paper, emphasis is given to measure the facet of health deprivation of children in the age group of 0-14 years, by considering two villages of Purulia district. First part focuses on the impedance of children's physical growth in terms of stunting, wasting and underweight. Second part emphasizes on the degree of association of health deprivation of children with mother's health status and financial capability of the family.

Key words: *Health deprivation, Stunting, Wasting, Underweight, Human Capital, Ante Natal Care, Immunization, IMR, MMR, Immunization, Nutrition, low BMI, full ANC, institutional delivery, Sanitation facilities.*

Introduction

Achievement of Sustainable development in an economy largely depends on the generation of enhanced quality of human capital. And this level of human capital is often determined by sound support of the Govt. and improved physical health status of the children of present generation. Children constitute the future backbone of the society. Today's children are tomorrow's adults and hence it is all the more perceived imperative that their capability be enhanced for preparing them to contribute to productive potential of an economy through investment in the improvement of their physical health. Sufferings of children from the problem of stunting,

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wasting and underweight, may mar the formation of sustained level of human capital which in turn may retard a country's future growth prospect. Childhood is the stage of formation of future human capital. Health related issues of children need proper attention since a disease-free healthy body can be both physically and mentally equipped to absorb the educational lessons (Datta,2022). Hence proper care should be taken to ensure quality nourishment of children's physical growth that call for provision of balanced nutritional diet, full immunization of the children, full ante natal care of mother. These are important as these factors are supposed to have direct and indirect influence on children's physical development and cognitive maturity. There is supposed to exist a high degree of association between children' physical growth and its determinants. This paper, tries to focus on the aspect of the health deprivation of children in the age groupof0-14years, based on survey of two villages in the Purulia district of West Bengal. First part focuses on the deterrent of children's physical growth in terms of stunting, wasting and underweight. Second part puts emphasis on the degree of association of health deficiency of children with regard to mother's health condition.

Stunting

Height-for-age is a measure of linear growth deterrent and snowballing growth deficits. Children whose height-for-age Z-score is below minus two standard deviations (-2 SD) from the median of the reference population are considered short for their age (stunted), or chronically undernourished. Children who are below minus three standard deviations (-3 SD) of median score, are considered harshly stunted. In India, NFHS-5 (2019-21) estimates 35.5% of children under age five years as stunted (too short for their age) which signify chronic under-nutrition.

Wasting

Weight-for-height index measures body mass in relation to body height or length and relates to current nutritional status. Children with Z-score less than minus two standard deviations (-2 SD) from the median of the reference population are considered as wasted, or acutely undernourished. Children with weight-for- height Z-score less than minus three standard deviations (-3 SD) from the median of the reference population are considered severely wasted. Wasting may result from inadequate food intake or from a recent episode of illness causing weight loss. Asper NFHS-4 (2019-21) survey, 19.3% of children under age five years are wasted (too thin for their height), which signify acute under-nutrition.

Underweight

Weight-for-age is a composite index of height-for-age and weight-for-height. It considers both acute and chronic under-nutrition. Children whose weight- for-age Z-score is below minus two standard deviations (-2 SD) from the median of the reference population are classified as underweight. Children whose weight-for- age Z-score is below minus three standard deviations (-3 SD) from the median are considered severely underweight. NFHS-5 results reveal that, 32.1% of children under age five years are underweight.

Objectives of the study

The main objectives of this study are

- to highlight on the health deprivation of children in terms of anthropometric indicators stunting, wasting and underweight.

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- to analyze the aforesaid types of deprivation in terms of their degree of association with health status of mothers at child bearing stage and economic status of the family.
- to prescribe appropriate policy directives to resist the process of child deprivation.

Literature Review

Spencer (1991) while working on Child poverty and deprivation in the UK observedan overall trend of inequality of health outcomes between the social groups. Income inequalities have become wider; children in lone parent and large families have beenmost affected by this trend.

Banerjee et al (2002) in their survey on health care and economic development in rural Rajasthan established a negative relationship between income and mortality. Individual's health is negatively affected by relative deprivation within a reference group. People live longer and healthier in rich groups than in poor groups because the households above poverty line spend a considerable amount of their monthly budget compared to the households living under BPL category.

In measuring deprivation in terms of physical development and calorie intake of children in two villages in Orissa, **Swain (2008)** concentrated on nutritional deficiencyarising out of income poverty, as the main cause of health deprivation of children. Most of the children work in fields or forests to collect Sal leaves and work long hours for a little pay surrendering their health and childhood. According to the author, ending poverty and accessto education are the crucial tools in the fight against deprivation of children in nutrition and health related matters.

Dreze and Khera (2012) accentuated on a regional pattern of human and child deprivation in India based on district level data. Their study shows that state average of component indices concentrates in the northern region of India (states like U.P, Uttarakhand, Rajasthan,Bihar, and Jharkhand) indicating higher regional deprivation of human and children compared to the southern and western region states like Kerala, Tamilnadu, Gujarat and Punjab.

In a paper Becker et al (2014) state that the Academy of Nutrition and Dietetics and American Society for Parenteral and Enteral Nutrition prepared a consensus statement to identify a basic set of indicators that can be utilized to diagnose and document undernutrition in the pediatric population. Based on availability of single data point, the recommended indicators comprise z scores of weights for height/length, body mass index for age, length/height for age, or mid-upper arm circumference. When two or more data points are available, indicators may also incorporate weight-gain velocity (younger than 2 years of age), weight loss (2 to 20 years of age), deceleration in weight for length/height *z* score, and inadequate nutrient intake.

In a **UNICEF Report (2014)** related to child poverty and deprivation in Uganda, child poverty is defined as children being deprived of two or more of seven dimensions that include nutrition, health, water, sanitation, shelter, education and information. Under-nutrition is the most common form of deprivation of Ugandan children. Further it is observed that children, especially females, who have to bear the task of fetching water from a distance suffer most from under nutrition.

In their article on "Extra cost of living with a disability" **Michael et al. (2017)** observed that disability causes extra costs for individual and households with disability. These extra-expenditures may arise for health care, food and the devices related with the specific disability.

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The costs depend on the nature ofimpairments, severity of disability, prices and accessibility of the of the items and with the environments the persons live or interact and the composition of households. Extra costs were observed among the persons with higher degree of disabilities, among the individuals with disabilities living alone or in a household with small size. The extra costs vary country to country with the differences of government's policy and programs. When the households with disability are poor, it led to the deprivation of capabilities.

According to **Qazi Moin (2018)** study, India is home of the worlds' hungry. The miserable health of Indian women and children is primarily due to lack of food security. Nearly one-third of adults in the country have a body mass index (BMI) below normal just because they do not have enough food to eat. Overall, India accounts for more than three out of every 10 stunted children globally. This is largely owing to lack of quality food, poor care and feeding practices and inadequatewater, sanitation and health services in the country.

In a multilevel analysis relating to child malnutrition and health deprivation, **Hallerod and Ekbrand (2018),** study reveals that child malnutrition decreases with increased command on the household resources by mothers and that will likely to reduce the probability of health deprivation. An increase in mother's educationhas not only an impact on socio economic status but also a protective effect on her children's health.

Perumal et al (2020) tried to develop composite indices of anthropometric data quality for use in multi-survey analysis of child health and nutritional status. They collected anthropometric data for children 0–59 months of age from all publicly available Demographic and Health Surveys (DHS) from 2000 onwards. They derived 6 indicators of anthropometric data quality at the survey level, including *1*) date of birth completeness, *2*) anthropometric measure completeness, *3*) digit preference for height and age, *4*) difference in mean HAZ (height-for-age *z* score (HAZ) < −2SD) by month of birth, *5*) proportion of biologically implausible values, and *6*) dispersion of HAZ and WHZ (weight-for-height *z* score (WHZ)<−2SD) distribution. Composite index of anthropometric data was devised based on Principal component factor analysis.

Gupta et al. (2020) in their article 'Improving Assessment of Child Growth in a Pediatric Hospital Setting' focused on enhancing the accuracy of height measurements in hospitalized pediatric patients under 5 years of age. The study developed composite indices of anthropometric data for height-for-age z-score (HAZ) and weight-for-height z-score (WHZ) using six indicators, including date of birth completeness, anthropometric measure completeness, digit preference, and dispersion of HAZ and WHZ distribution. The developed composite indices provide a useful tool for assessing and comparing the quality of anthropometric data in large-scale surveys, aiding in more accurate monitoring of child growth.

The study by **Sethi** et al. (2024) aimed to enhance the quality of anthropometric assessments—specifically weight and length measurements—for children under five years old at an urban primary health centre in New Delhi, India. They formed a Quality Improvement (QI) team comprising doctors and key health staff. Performed a baseline assessment to identify gaps in current anthropometric measurement practices. The study concluded that standardizing anthropometric assessments in primary healthcare settings is achievable through stakeholder involvement and capacity building of healthcare providers using QI approaches. They utilized root cause analysis to determine underlying issues to ensure the sustainability of these improvements.

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Data collection and Methodology

The analysis of this study is entirely based on primary data which are collected through direct interview-method using simple random sampling method from the two villages, **Dumdumi** and **Palanja** from Purulia district. Although weighted sample is mostly desirable in health survey practice, in this study the sample is drawn using simple random sampling where the need for weighting is minimal. Further Unweighted analyses are easier to understand and implement, especially for researchers or clinicians which often involve using complex statistical weighting techniques. In some cases, unweighted analysis is preferred when more accurate result is expected, in case the sample is relatively representative of the target population or the sampling design is not heavily skewed. For our present study a questionnaire was prepared. The questionnaire has four parts-

First part is to focus on the socio-economic background of the respondents. **Second part** captures the data pertaining to the issue of the educational deprivation of the children with the correlated factors that have impact on their educational attainment in both direct and indirect manner**. Third part** encompasses the data on health deprivation of their children in terms of health indicators such as stunting (height as per age), wasting (weight as per height) and underweight and the correlated factors and **Last part** collects data on the children with special needs on five categories (Hearing, Visual, Mental, Speech and locomotor impaired) and the associated factors.

Primary data are collected on children's height and weight as per age from households based on the use of measuring tape and portable weighing machine. Subsequently these dataare compared with the I.C.M. R's (Indian Council for Medical Research) standard- chart relating to average height and weight of boys and girls at different ages. The deficit of height as per age is dubbed as stunted, the deficit of weight as per height is considered as wasted and the discrepancy of weight as per age of the childrenare counted as underweight.

In order to test the significance of the observed relationship in regard to expected associated between child health related underachievement (stunting, wasting and underweight) and its determinants separately, Chi-square (χ^2) statistic is considered as appropriate. In this context, we represent the data in 2×2 contingency table before applying the formula

$$\text{Chi-square}(\chi^2) = \frac{N(ad-bc)^2}{(a+c)(b+d)(a+b)(c+d)}$$

Where N represents total frequency, ad means principal diagonal cross product, bc indicates the off diagonal cross product and (a+c), (b+d), (a+d) and (c+d) are the marginal totals. This chi-square has been developed based on the use of the (2×2) contingencytable. Here N indicates the number of observations from total surveyed families. As this Chi-square statistics only signifies the relation among the variables, Phi-coefficient (Φ) has been used to measure the degree of association among its determinants.

$$\text{Phi-coefficient } (\Phi) = \sqrt{\frac{\chi 2}{N}}$$

Different tables and graphs have also been used to render the analysis readily comprehensible.

Study Region: Purulia District

Purulia district is an important district of western part of West Bengal. Among few districts

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of Jangalmahal, Purulia is inhabited by groups of tribal people such as Santhals, Kurmi and Bhumij. The Kurmis are the most dominat community (constitute 65% of the population in Purulia, census, 2011) across the district. And since the same community are the dominant group of people in the selected two villages, they are mostly representative of the district. which are Purulia has sub-tropical climate characterised by high temperature and low rainfall. Several rivers flow such as Subarnarekha, Kangshabati, Dwarakeswar, Silabati across the district. According to 2011 census the district has total population of 2927965 out of which males are 1496996 and females are 1433119. In Purulia 87.26 percent are residing in rural areas and 12.74 percent in urban areas. The literacy rate of this district is 65.38 percent (male-74.18 and female-37.15 percent). The children of scheduled tribe (ST) are most likely to be vaccinated while the children from other backward class (OBC) are least vaccinated. The economy of Purulia district is mainly led by Agricultural activities, Tourism, small and medium scale industries. The Lac and Sericulture are core industries of Purulia. It contributes 90 percent of the state output of Lac and Sericulture industry. 70000 people are involved in this allied sector. Now sponge iron, cement industries are flourishing along with the power generation. Tourism is now becoming the major source of income in Purulia. In 2006, Ministry of Panchayati Raj enlisted Purulia district as one of the most backward districts (250th out of 640) in the country for which the district has received fund under the Backward Regions Grant Fund (BRGF) Scheme. Under nutrition of children is also an acute problem in Purulia. Since the village is largely populated by the Kurmi community which also represents the district population of Prulia.

Anaemia among children (percentage of children age 6-59 months) in Purulia is 66.8% that increased to 77.9% (NFHS-5) and anaemia among women (percentage of women age 15-49 years) in Purulia is 80.0% and decreased to 72.2% (NFHS-5). Full ANC (at least four ante natal care visits, at least on TT injection and Iron Folic Acid tablets or syrup taken for 100 or more days) of mother in Purulia is 68.6% which is below state average (76.5%). All vaccinations (BCG, measles, and three doses each of DPT and polio vaccine) in Purulia is 87.4%. Literacy rate of Purulia-II is 63.39%. Male literacy is 65.02 percent and female literacy is 42.08 percent. Gender inequality is the main problem of this block. Sex-ratio of Purulia-II blockis 960 which greater than the district average (957). A common guideline for descriptive research is to cover at least 10% of the population a sample to infer about the population characteristics on the basis of sample survey, NFHS-5 covers 950 households of the Purulia district during collection of country level facts. In our field survey 120 households have been covered as sample selecting 60 from each of two villages through simple random sampling technique. Based on existing guidelines it can be considered as a reasonable sample size.

According to **Casadei and Kiel (2022),** The Center for Disease Control and Prevention (CDC), advocates anthropometry as an important assessment mechanism of nutritional status in children and adults. They serve to evaluate the general health status, nutritional sufficiency, and the growth and developmental pattern of the child.

The central components of anthropometry focus on height, weight, head circumference, body mass index (BMI), body circumferences to assess for adiposity (waist, hip, and limbs), and skinfold thickness. The American Academy of Pediatrics and the Child Health and Disability Prevention (CHDP) Program Health Assessment Guidelines indicates that, precise successive anthropometric measurements can help make out children's fundamental medical, nutritional, or social problems. Anthropometric measurements in terms of weight, length and head circumference are perceived important for infants and toddlers under 2 years of age. Further weight and length and BMI is recommended for all children 2 years and above to determine

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adequacy of nutritional position and risk of obesity.

Department of Nutrition for Health and Development of World Health Organization (WHO) developed The Anthro Survey Analyser as an online tool which serves users in undertaking comprehensive analysis of anthropometric survey data for children under five years of age based on weight and height. This version of the tool provides results for four of the anthropometric indexes: height-for-age, weight-for-age, weight-for-height, and bodymass-index-for-age. This online tool is purported to set up country capacity on data analysis and reporting on child malnutrition outcomes.

A. Dumdumi Village:

Dumdumi is a village in Chharra-Dumdumi Gram Panchayat (GP) under Purulia-II block. Total geographical area of Dumdumi is 777 hectares. According to 2011 census, total population of the village is 3768, out of which male population is 1913 and female population is 1855.Population of children of 0-6 years is 587. The sex- ratio of the village is 970 a little higher than the state average (950). Child Sex Ratio of this village as per census, 2011 is 912, lower than state average of 956. Literacy rate of Dumdumi is 66.68 percent, lower than the state average of 76.26 percent. While the male literacy is 81.94 and female literacy is 51.11 percent. Gender difference is quite prominent in literacy. According to last census thisvillage has 27.36% SC population. 1031 out of 3768 total population belong to Scheduled Caste (SC) community. Dumdumi has no tribal (ST) population. Itappears from census data that people are mainly engaged in agriculture and allied economic activities in primary sector. Out of total workers (1402) only 723 are engaged as main workers (earning from present employment more than 6 months) and 679 are employed as marginal workers (earning from present employment less than 6 months), 163 workers are involved in agricultural activities of their own land and 97 are employed as agricultural labourers. The village has three primary schools, one upper primary school and one health centre. All households are coveredwith 100 percent supply of electricity and the sources of drinking water are well, tube well and hand pump.

B. Palanja Village:

Palanja village is located in Pindra Gram Panchayat (GP) under the same block. The geographical area of Palanja is 339.1 hectares. According to 2011 census, the total population of the village is 3142 out of which 1618 are male and 1524 are female. Population of children of 0-6 years is 537 (17.09%). The sex- ratio of the village is 942 which is lower than the state average (950). Child Sex Ratio of this village as per census, 2011 is 925, lower than state average of 956. Literacy rate of Palanja is 62.73 percent lower than the state average of 76.26 percent. While the male literacy is 73.94 and female literacy is 50.87 percent. Gender difference is quite high in literacy. According to last census this village has 27.36% SC population. 242 out of 3142 total population belong to Scheduled Caste (7.70%) community. Palanja has 236 tribal (10.69%) population. It appears from census data that people are mainly engaged in agriculture and allied economic activities in primary sector. Now construction work activities are flourishing widely. A number of people of Palanja are involved in Purulia town (5 km away from the village) as mason or contractor. The village has two primary schools (one Urdu medium and Bengali medium) and no provision of health care centre. All households are covered with 100 percent supply of electricity and the sources of drinking water are well, tube well and hand pump. Poor drinking water supply coerce people depend on ponds and thus increases the chances of getting infected of various diseases. One community water tank has been constructed for drinking water but it is not functional. Though

all households of Palanja have been covered by electricity facility, the supply gets interrupted frequently. Upper primary schools and higher education institutions are available in town or municipality area which is at least 5 km away from the village. This results in poor attendance of school going children. So, problem of drop out arises at upper primary and higher education level.

Socio-Demographic status of children and their parents in the study region

Table No. 1: Socio-Economic status of Dumdumi and Palanja

Villages	Dumdumi		Palanja	
GP	Chharra-Dumdumi GP		Pindra GP	
Block	Purulia-II Block		Purulia-II Block	
Family surveyed	60		60	
Total children (0-18 years)	137		114	
BPL families	BPL-49	APL-11	BPL-29	APL-31
Families	Hindu- 60	Muslim-0	Hind-28	Muslim-32
Father's occupation	Labour-40 & Agri-15	Service-2	Labour-29 & Agri-9	Service-10 & Busi-9
Mother's occupation	Family work-60		Family work-60	
Father's education	PRY-27	UP-16 & HE-6	PRY-32	UP-19 & HE-5
Mother's education	PRY-23	UP-13 & HE-7	PRY-36	UP-13 & HE-2
children (6-14yr)	102	Male-53(51.96%); Female-49 (48.04%)	91	Male-48 (52.72%); Female-43 (47.28%)
School Enrolment	Govt. School	All	Govt. School-87	Private-4
Nature of attendance	Good- 84 -82.40%	Poor-18 (17.6%)	Good-67 (73.6%)	Poor-24 (26.4%)
	Male- 44(52.3%), Female -40(47.70%)	Male- 9(50%), Female-9 (50%)	Male-33(49.2%), Female-34 (50.8%)	Male-14(58.3%), Female-10 (41.7%)
No. of children (0-14yr)	102		96	
Stunting	Male-19(37.2%)	Female-12 (23.5%)	Male-20(35.7%)	Female- 14(35%)
Wasting	Male- 14(27.04%)	Female- 10(19.6%)	Male-14(25%)	Female- 13(32.5%)
Underweight	Male-21 (41.1%)	Female-22 (43.1%)	Male-19(33.9%)	Female- 20(50%)
Full ANC of mother	Yes-14 (23.33%)	No-46 (76.66%)	Yes-18(30%)	No-42 (70%)
Nutritional diet	Yes-Nil	NO- 102	Yes-31(32.22%)	No-65(67.7%)
Anaemic during pregnancy	42 (70%)	18 (30%)	Yes-35(58.33%)	No-25 (41.66%)

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No. of disabled children	2 (1.96%)	0	6(6.25%)	0
Nature of disability	Seeing-1	Speech-1 Move-1	Mental-2	Speech-2 Hearing-2

Source: Primary Survey

From Table No. 1, it is clear that financial condition of Dumdumi is more awful than Palanja. This is because 49 out of 60 families are living below poverty line. Most of the workers are employed as marginal workers. They are engaged in agricultural activities which is mainly seasonal in nature. Since the village has no proper irrigation facilities and no alternative job opportunities, the labourers are employed but in disguised form and seasonally unemployed form. All children of (6-14 years) of Dumdumi are enrolled at government primary and upper primary schools, whereas inPalanja few students (4) are enrolled at private schools also. Financial abilities of Palanja are comparatively better as the village has less BPL families. The main problem of both the villages is the children's health condition. Most of them are suffering from the problems of stunting, wasting and underweight.

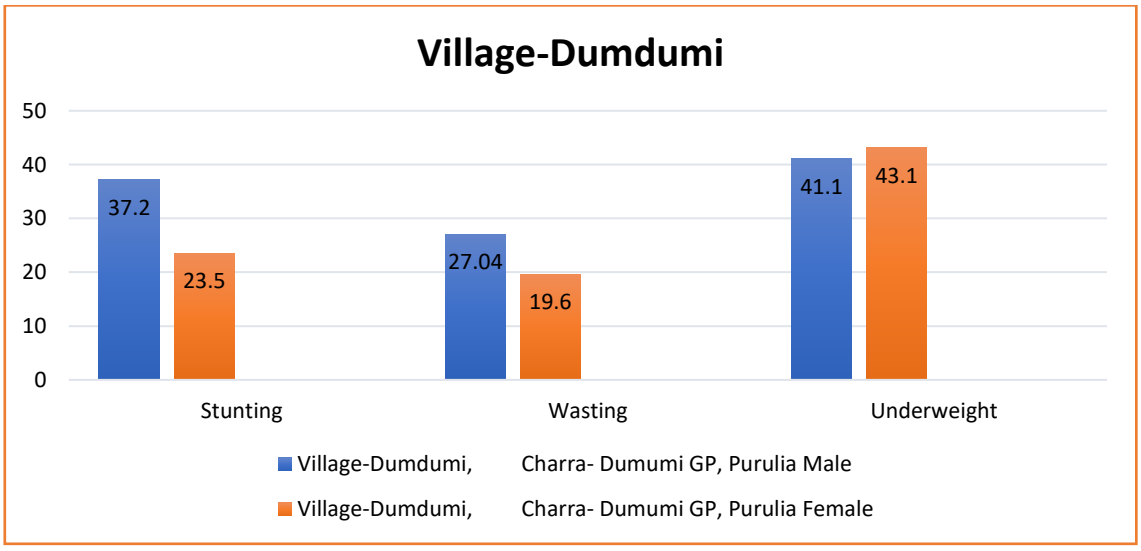

Fig. 1: Diagrammatic presentation of health problem of the village, Dumdumi

Table 2 describes the relative status of health deprivation of children of Dumdumi and Palanja. All the health indicators show the high concentration of the health problem. The intensity of the problem can be perceived from the table-1.

Table No. 2: Health deprivation of children in two villages of Purulia districts

Health Deprivation (0-14 Years)	**Dumdumi**		**Palanja**	
Stunting	Male- 19/51 (37.2%)	Female- 12/51 (23.5%)	Male-20/56 (35.7%)	Female- 14/40 (35%)
Wasting	Male- 14/51 (27.04%)	Female- 10/51 (19.6%)	Male-14/56 (25%)	Female- 13/40 (32.5%)
Underweight	Male- 21/51 (41.1%)	Female- 22/51 (43.1%)	Male-19/56 (33.9%)	Female- 20/40 (50%)

Source: Primary Survey

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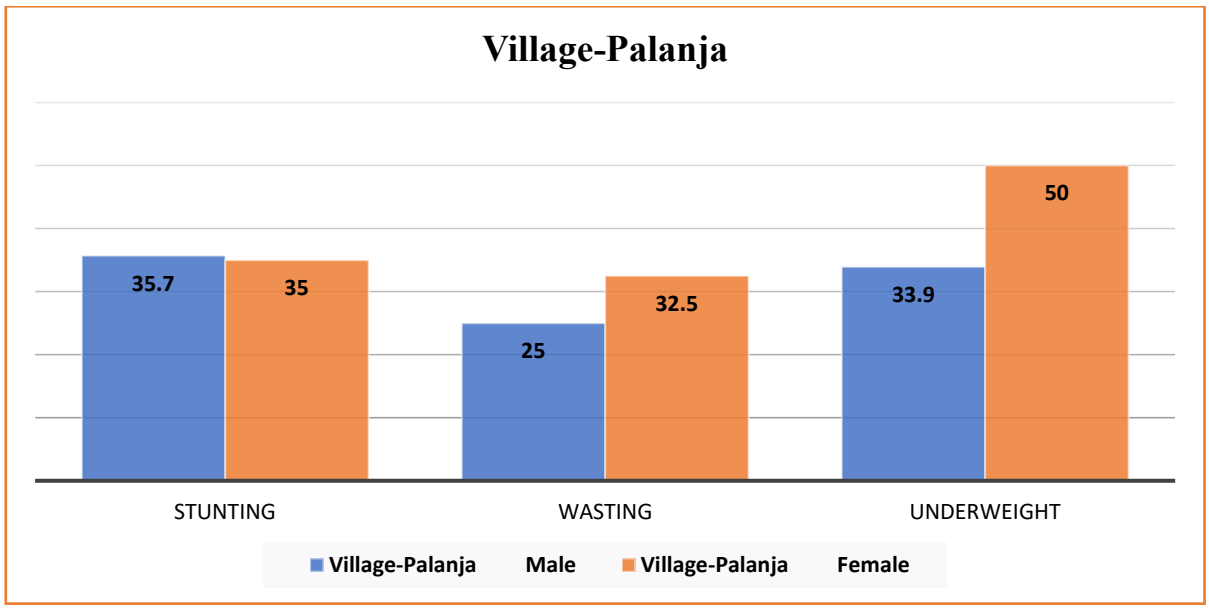

Fig.2: Diagrammatic presentation of health problem of the village, Palanja

There are several measures of stunting, wasting and underweight at international level following the guidelines of United Nations. In our present study, we took the help of measure of WHO's on Child Growth and Malnutrition ,1995. The prevalence of children's health deprivation of Dumdumi village is represented in the following table:

Table No. 3: Prevalence of children's health deprivation of Dumdumi village,Purulia

Indicator	Prevalence cut-off values of health deprivation	Health status of the village, Dumdumi, Purulia			
		Male (%)	Status	Female (%)	Status
Stunting	<20%: Low prevalence 20-29%: Medium prevalence 30-39%: High prevalence ≥40%: Very high prevalence	37.2	High prevalence	23.5	Medium prevalence
Wasting	< 5%: Low prevalence 5-9%: Medium prevalence 10-14%: High prevalence ≥15%: Very high prevalence	27.04	Very high prevalence	19.6	Very high prevalence
Underweight	<10%: Low prevalence 10-19%: Medium prevalence 20-29%: High prevalence ≥30%: Very high prevalence	41.1	Very high prevalence	43.1	Very high prevalence

Reference: WHO, Global Database on Child Growth and Malnutriton,1995
Source: Primary Survey

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Table 3 shows high prevalence of stunting for male (37.2%) and underweight for both male (41.1%) and female (43.1%). The problem of wasting is at critical level both for male (27.4%) and female (19.6%) children.

Table 4: Prevalence of children's health deprivation of Palanja village, Purulia

Indicator	Prevalence cut-off values of health deprivation	Health status of the village, Palanja, Purulia			
		Male (%)	Status	Female (%)	Status
Stunting	<20%: Low prevalence 20-29%: Medium prevalence 30-39%: High prevalence ≥40%: Very high prevalence	35.7	High prevalence	35	High prevalence
Wasting	< 5%: Low prevalence 5-9%: Medium prevalence 10-14%: high prevalence ≥15%: Very high prevalence	25	Very high prevalence	32.5	Very high prevalence
Underweight	<10%: Low prevalence 10-19%: Medium prevalence 20-29%: High prevalence ≥30%: Very high prevalence	33.9	Very high prevalence	50	Very high prevalence

Reference: WHO, Global Database on Child Growth and Malnutriton,1995

Source: Author's own calculation from primary data

Table 4 reveals high prevalence of stunting and underweight both for male and female. The problem of wasting is also at critical level. Though more than 50% households of Palanja are economically solvent, due to their poor nutritional diet, low parental education, heavy dependence on traditional method of treatments, high prevalence of anaemia during pregnancy, less than full ANC of mothers, the children are suffering from the problems of stunting, wasting and underweight.

Association between receipt of health facility by mothers during pregnancy and children health status. In the earlier section, the health problem of the chiren and socio-demographic condition of parents have been analysed. In this section the degree of association of the child health problems of stunting, wasting and underweight with the variables such as less than full ante natal care of mother (ANC), anaemia during the pregnancy of the mother and the financial capability of the family indicated by BPL.The level of association of either of these factors with the child health problems has been checked with chi-square test at 5 % level of significance and corresponding degree of association between the variables computed with phi-coefficient (Φ). Here full ANC of mothers cover at least four ante natal visits, at least one Tetanus Toxoid (TT) injection and Iron and Folic Acid (IFA) tablets or syrup taken over 100 or days. Less than full ANC means mothers did not receive full series of the above-mentioned health facilities. Full antenatal care of pregnant women increases the chances of new-born baby to be healthy and reduces the probability of a child to be disabled. Less than

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full ANC increases both IMR and MMR. So, the variable less than full ANC is assumed to be positively associated with the health deprivation of the children. Similar result is noticed by Dutta. & Singh. (2016) in their study on 'Analysis of Child Health Deprivation in India: Focus on health and educational perspective. They observed that the variable 'Full ANC' is negatively associated and found to be significant in explaining the level of child health deprivation at different levels. They also found that the variable 'BPL' is positively associated with the child health deprivation problem. The distribution of mothers according to full (or less) than antenatal care (ANC) andthat of children with either of the stated health problems (or not) in case of Dumdumi village is depicted in table-5.

Table 5: Distribution of mothers according to ANC and child health problem, Dumdumi

Health deprivation	Less than full ANC of mother	Full ANC of mother	Total
Either of the problems stunting, wasting and underweight	41	6	47
No problems	5	8	13
Total	46	14	60

Source: primary survey

$$\text{Chi-square}(\chi^2) = \frac{60(41\times8-5\times60)^2}{(41+6)(5+8)(41+5)(6+8)}$$

$$= 13.54$$

Here N=60 represents mothers of 60 households from Dumdumi village, Purulia district. In the village Dumdumi, Purulia 41 mothers out of 60 surveyed families did not complete full ante natal care either from government health Centre or from private health facilities and their children are facing either of the health deficiencies such as stunting, wasting and under-weight. Out of 14 full ANC of mothers, 8 faced no such problems. Here null hypothesis (H0) specifies the variable full ANC does not have any effect on either of the health problem, stunting, wasting and underweight of the children of the village, Dumdumi. The alternative hypothesis (H1) specifies the variable full ANC has significant effect in explaining either of the health problem of the children of the village, Dumdumi. The calculated Chi-square(χ^2) value is 13.54 which is greater than the critical value (3.841) at 5% level of significance with df=1. This means that the null-hypothesis is rejected and the alternative hypothesis is accepted. Thus, we can accomplish that the variable full ANC received by the mothers of Dumdumi village of Purulia district explains the variability of the health problems (stunting, wasting and underweight) of the children of Dumdumi village.

The distribution of mothers according to full (or less) than antenatal care (ANC) and that of children with either of the stated health problems (or not) in case of Palanja village is depicted in table 6.

Table 6: Distribution of mothers according to ANC and child health problem, Palanja

Health deprivation	Less than full ANC of mother	Full ANC of mother	Total
Either of the problems stunting,wasting and underweight	36	7	43
No problems	6	11	17
Total	42	18	60

Source: Primary Survey

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$$\text{Chi-square } (\chi^2) = \sqrt{\frac{60(36\times11-6\times7)^2}{(36+7)(6+11)(36+6)(7+11)}}$$

$$= 13.60$$

Here N=60 represents mothers of 60 households from Palanja village, Purulia district. In the village Palanja, Purulia 36 mothers out of 60 surveyed families didnot obtain full ante natal care either from government health Centre or from private health facilities and their children are facing either of the health deficiencies such as stunting, wasting and under-weight. Out of 18 full ANC of mothers, 11 faced nosuch problems. The Chi-square statistic and computation of phi coefficient have been carried out as before. The calculated Chi-square (χ^2) value is 13.60 which is greater than the critical value (3.841) at 5% level of significance with df=1. This denotes that the null-hypothesis (no association of the variable, less than full ANC of mother with either of the problems) is rejected and the alternative hypothesis (the existence of association of the variable, less than full ANC of mother with either of the child health problems) is accepted.

$$\text{Phi -Coefficient } (\Phi) = \sqrt{\frac{\chi^2}{N}}$$

$$= \sqrt{\frac{13.60}{60}}$$

$$=0.47$$

This Φ=0.47 represents the high degree association between the variable full ANC and health problem of the children of Palanja village.

Anaemia during pregnancy

Anaemia is a biological imbalance identified by the low level of hemoglobin in the blood. It is mainly caused by iron deficiency. Hemoglobin less than 11.9gm/dl represents the anaemic condition. Anaemia of women during pregnancy increases the probability of IMR and MMR. It results in maternal mortality, reduced physical and mental capacity, premature delivery, low-birth weight, impaired cognitive development. It also adversely impacts on cognitive and physical development ofthe children. Anaemia is a major health problem in West Bengal. It is 63.2% in Purulia among 6-59 months children and 80% in Purulia among 15-49 years women (NFHS-4). So, the problem is acute in Purulia. Hence endeavor has been made to explain the health deprivation of the children with the indicator anaemia of the mother during pregnancy. The distribution of pregnant mothers according to anaemic condition (or no anaemia) and that of children with either of the stated health problems (or not) in case of Dumdumi village is shown in table 7.

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Table 7: Distribution of anaemic mothers and child health problem, Dumdumi

Health deprivation	Anaemic mother	Non-anaemic mother	Total
Either of the problems stunting, wasting and underweight	35	8	43
No problems	7	10	17
Total	42	18	60

Source: Primary Survey

$$\text{Chi-square}(\chi^2) = \frac{60(35\times10-7\times8)^2}{(35+8)(7+10)(35+7)(8+10)}$$

$$= 9.38$$

Here N=60 represents mothers of 60 households from Dumdumi village, Purulia district. Out of 42 anaemic mothers, 35 suffered from anaemia problem during pregnancy while their children had suffered from either of the problems stunting, wasting and underweight. The corresponding Chi-square (χ^2) value is 9.38 which is greater than the critical value (3.841) at 5% level of significance. This means that the null-hypothesis (no association of the variable, anaemia of mother during pregnancy with either of the child health problems) is rejected. Thus, we can say that the variable anaemia of the mothers of Dumdumi village of purulia district is significantly associated with the existence of child health problems (stunting, wasting and underweight). Now the value of phi-coefficient is:

$$\text{phi-coefficient } (\Phi) = \sqrt{\frac{9.38}{60}}$$

$$= 0.39$$

This Φ=0.39 represents the medium degree of association between the variable anaemia of mothers during pregnancy and health problem of the children in Dumdumi village. The distribution of pregnant mothers according to anaemic condition (or no anaemia) and that of children with either of the stated health problems (or not) in case of Palanja village is shown in table 8.

Table 8: Distribution of anaemic mothers and child health problem, Palanja

Health deprivation	Anaemic mother	Non-anaemic mother	Total
Either of the problems stunting, wasting and underweight	30	10	40
No problems	5	15	20
Total	35	25	60

Source: Primary Survey

From the table 8 it is found that out of 35 anemic mothers during the state of pregnancy, 30 have children afflicted with either of the health problems like stunting, wasting and underweight.

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$$\text{Chi-square } (\chi^2) = \frac{60(30\times15-5\times10)^2}{(30+10)\,(5+15)\,(30+5)\,(10+15)}$$

$$=13.71$$

The corresponding calculated Chi-square (χ^2) value is 13.71 which is greater thanthe critical value (3.841) at 5% level of significance with df=1. This means that the null-hypothesis (no association of the variable, anaemia of mother during pregnancy with either of the child health problems) is rejected and the alternative hypothesis (existence of association) is accepted. Thus, we can say that the variable anaemia of the mothers of Palanja village of Purulia district is highly connected with the existence of stated child health problems (stunting, wasting and underweight).

The corresponding phi coefficient yielding the magnitude of association is given by:

$$\text{Phi-Coefficient } (\Phi) = \sqrt{\frac{13.71}{60}}$$

$$=0.47$$

This Φ=0.47 represents high degree of association between the variable anaemia of mothers during pregnancy and health problem of the children of Palanja village.

Families Below Poverty Line (BPL):

In capability approach, Amartya Sen has defined poverty not only in terms of income but also relating it to some basic functioning such as life expectancy, infant mortality, the ability to be well-nourished and well sheltered, basic health care as capabilities. Deprivation of such capabilities reflecting poverty may lead to the extreme forms of health and educational problems. Thus, as the percentage of families below poverty line rises, malnutrition (lack of vitamins and minerals), inadequate access to preventive and medical care with better hygiene facilities (such as immunization, open defecation free society, proper sanitization) lead to increased probability of different health problems. Water, Sanitation and Hygiene (WASH) are basic facilities of good public health. When a society has ability to access clean drinking water, basic sanitation facilities and proper habit of hygiene practices, then everyone has a better opportunity of availing good health, and being less vulnerable to diseases. Therefore, there is supposed to be a positive correlation between poverty and health deprivation.

The distribution of families according to financial capability (BPL or APL) and that of children with either of the stated health problems (or not) of Dumdumi village of Purulia districted is presented in table 9.

Table 9: Distribution of families (BPL or APL) and child health problem, Dumdumi

Health deprivation	BPL	APL	Total
Either of the problemsstunting, wasting and underweight	42	6	48
No problems	7	5	12
Total	49	11	60

Source: Primary Survey

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In the village Dumdumi, Purulia district 42 out of 60 surveyed families are of BPL. The calculation of Chi-square test statistic and computation of phi coefficient have been performed as:

$$\text{Chi-Square } (\chi^2) = \sqrt{\frac{60(42\times5-7\times6)^2}{(42+6)(7+5)(42+7)(6+5)}}$$

$$= 4.87$$

This is greater than the critical value (3.841) at 5% level of significance with df=1. This means that the null-hypothesis is rejected and the alternative hypothesis is accepted. Thus, we can say that the variable, BPL of Dumdumi village is associated with the variability of the health problems (stunting, wasting and under-weight) of the children. The extent of the relationship between the variables has been measured as:

$$\text{Phi-Coefficient } (\Phi) = \sqrt{\frac{4.87}{60}}$$

$$=0.28$$

Thus Φ =0.28 represents the degree of association between the variable BPL andhealth problem of the children in Dumdumi village.

The distribution of families according to financial capability (BPL or APL) and that of children with either of the stated health problems (or not) of Palanja village of Purulia districted is presented in table 10.

Table 10: Distribution of families (BPL or APL) and child health problem, Palanja

Health deprivation	BPL	APL	Total
Either of the problems stunting, wasting and underweight	23	11	34
No problems	6	20	26
Total	29	31	60

Source: Primary Survey

In the village Palanja, Purulia district23 out of 60 surveyed families are of BPL. Thecomputation of Chi-square test and of phi-coefficient have been carried out as:

$$\text{Chi-square } (\chi^2) = \sqrt{\frac{60(23\times6)-(6\times11)^2}{(23+11)(6+20)(23+6)(11+20)}}$$

$$=11.72$$

The calculated Chi-square value (11.72) is greater than the critical value (3.841) at 5% level of significance with df=1. This means that the null-hypothesis (no effect of independent variable, BPL on either of the problems) is rejected and the alternative hypothesis (the effect of independent variable, BPL on either of the problems) is accepted. Thus, we can conclude that the variable, BPL of Palanja village explains the variability of the health problems (stunting, wasting and under-weight) of the children of Palanja village of Purulia district.

Now the magnitude of the relationship among variables has been represented as follow:

$$\text{Phi-Coefficient } (\Phi) = \sqrt{\frac{11.72}{60}}$$
$$= 0.40$$

This $\Phi = 0.40$ represents the degree of association between the variable BPL and health problem of the children of Palanja village.

Concluding Remarks

The NFHS-4 data shows that the problem of stunting under the age group of 5 years are38.4% (35.5% in NFHS-5), wasting 21% (19.3% in NFHS-5) and underweight 35.4% (32.1% in NFHS-5)**.** Although these problems registered some decrease over time, still there is no space for complacency**.** According to ICMR, deficiency of key vitamins and minerals are responsible for such health problem. Lack of zinc results in the stunting problem of the children. Iron deficiency damages the brain, impairs the cognitive development. NFHS-5 data shows 52.2% (50.4% in NFHS-4) pregnant women (15-49 years) are anaemic and 67.1% (58.6%) of children (6-59 months) are anaemic. The anemia problem has somewhat intensified over time.To delve deeper into the problem, field survey is conducted in two villages of Purulia district of West Bengal namely Palanja and Dumdumi. This is because, labourers are mainly employed as mason in construction and allied activities at high wages. Some of them also work as contractors and as labour suppliers. In Dumdumi workers are mainly employed in agriculture. They are basically unemployed in disguised form. Having no other alternatives job opportunities, they are casually employed in nearby Purulia town and migrate to other states at low wage in brick industry, or as drivers, as mason, or as helper in construction industry. Similar results are noticed in a study on status of unemployment in Chhara-Dumdumi GP in rural Purulia by Patra et al. (2019). The survey shows that 71.26 percent educated people are unemployed in this GP outof which 89.22 percent are casually employed less than 12 days per month and 10.78percent worked more than 12 days per month. So, this massive unemployment leads to the families into perpetual poverty. In both Dumdumi and Palanja village of Purulia district, children are suffering from stunting at high and medium level, wasting and underweight are at very high level. Though per capita income of Palanja in Purulia is better, this comparatively better position does not get reflected in good health status since the families have to carry out their earlier poor diet habit, lack of balanced nutritional diet i.e., less consumption of fruits and milk. Another habit has been noticed that some households have good income but less consumption and more savings. Even today some families are credulous and heavily depend on traditional local medication. This is mainly due to the low-level of parental education. Anaemia among children in Purulia is 77.9% (NFHS-5) which has increased considerably from 66.8% (NFHS-4). Anaemia among pregnant women here is 72.2% (NFHS-5) which little bit improved compared to 80% (NFHS-4). Full ANC of mother in Purulia is 68.6% which is below the state average (76.5%). All vaccinations in Purulia have been 87.4% whereas national average is 94.5% (NFHS-5). It establishes the worse health status of children as well as of women of Purulia. It has been reflected in table-3 & 4. Another important reason of this health problem is that a good number of families in the Dumdumi village (49 out of 60) and Palanja (29 out of 60) live below the poverty line. Deficiency of such capabilities reflecting poverty may lead to the extreme forms of health deprivation. Thus, as the percentage of families below poverty line rises, malnutrition (lack of vitamins and minerals), inadequate access to preventive and medical care with better hygiene facilities (such as immunization, open defecation free society, proper sanitization) lead to increased probability of such health problems.

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Policy Prescriptions

In 2006, Ministry of Panchayati Raj enlisted Purulia District as one of the most backward districts (250th out of 640) in the country for which the district has received fund for development under Backward Regions Grant Fund (BRGF). No single intervention alone can solve this problem of health deprivation of the children. So, a comprehensive approach is needed to address the problem.

- National Nutrition Mission or POSHAN (2018), National Health Mission (2013), National policy for Children (2013), Reproductive, Maternal, New-born Child plus Adolescent Health (RMNCH+A, 2013) by MoHFW and ICDS Systems Strengthening and Nutrition Improvement Project (ISSNIP, 2013) by MoWCD are such comprehensive measures taken by the central government to reduce under-nutrition and achieve improved healthcare for both mothers and children. Some community-based intervention for universal access to safe drinking water, sanitation, improved health and hygiene practices for ensuring open defecation free (ODF) environment through Swachh Bharat Abhiyan, mission for vaccination and immunization, full coverage and implementation of food security may be the ways out of this great challenge.

- Under nutrition of mother and children is the crucial factor for such extreme form of child health deprivation, 'Total Diet Program' instead of Cooed Mid-Day Meal (CMDM) Program through inclusiveness of both mothers and children may enhance the nutritional level of both of them.

- Since large numbers of family are below poverty line, so it is beyond the capacity of the households to accommodate proper health care and nutrition for their children. In such situations, Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) for securing jobs for 100 days and creation of Self-Help Group (SHP) for empowering the women financially may enhance the capability of the households to some extent and thereby ensure the health and nutrition of their families.

- For attaining sustained health outcome, there is need for integration of ICDS, NHM, NNM with active involvement of elected members of Panchayati Raj system from village level to district level. The functioning of the layer be nutrition supplementation at ICDS centre monitored by Gram Panchayat (GP), health and nutrition screening of children and mothers at Block level monitored by Panchayat Samiti and Health and nutrition rehabilitation at district level monitored by Zila Parishad.

- Since Purulia is a backward district, more resources should be allocated in the budget with proper monitoring to have a sustained outcome in the health sector.

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