Gender Differences in Nutritional Status of Children in Tea Gardens of Darjeeling: Based on Conventional Indices and Composite Index of Anthropometric Failure

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Abstract: *Objectives*: The study aims to assess the nutritional status of children aged 1-5 years and its relationship with gender. Further, it also tries to assess the nutritional status of children using conventional indices and the composite index of anthropometric failure (CIAF) and suggests the appropriate method to estimate undernutrition among children.

Materials and Methods: The area selected for the study is the tea gardens of Darjeeling. The study is based on the primary survey, and a total of 400 children were included in the study. A Chi-square test is conducted to find out the differences in the nutritional status of children gender-wise.

Results: The analysis indicated that the level of undernutrition in tea gardens of Darjeeling is very high (51%). The level of undernutrition estimated through conventional indices indicated that the level of stunting, wasting, and underweight are 43.8%, 20.2%, and 36.2%, respectively, whereas the composite index of anthropometric failure estimated more prevalence rate (51.2%). The analysis indicates that the conventional indices underestimate the prevalence of undernutrition. On the contrary, a composite index of anthropometric failure (CIAF) gives better estimates of undernutrition. Both the indices of nutrition in the study area indicated higher undernutrition among girl children than a boy. However, no significant differences in the nutritional status gender-wise exist.

Conclusion: The result depicts the positive sign as it contradicts the general belief that a boy child is more nourished than a girl. However, half of the children in tea gardens of Darjeeling aged 1-5 years, irrespective of gender, are undernourished. The paper highlights the urgent need to work out nutritional strategies to improve child health in the study area.

Keywords: Nutrition, Children, Gender, Child Health, Health Care.

INTRODUCTION

Undernutrition among children is one of the main causes of ill health and mortality among children. It commonly affects all ages, but infants and young children are the most vulnerable because of their high nutritional requirements for growth and development [1]. It is the most important indicator of the health of a child [2]. UNICEF defines under-nutrition as the outcome of insufficient food intake and repeated infectious diseases. It includes the child being too short for one's age, i.e. (stunting), dangerously thin for one's height (wasting), underweight for one‘s age (underweight), and deficient in vitamins and minerals (micronutrient malnutrition). In India, according to the fourth round of National Family Health Survey data (2015-16), it is observed that 39 % of children under age five years are stunted, 15% of children are wasted, and almost one-third of total children are underweight for their age [3]. Studies consistently show that socio-economic, demographic, cultural, environmental, and biological factors are important factors associated with child nutrition [4-10]. Adequate maternal nutrition before and during pregnancy and lactation, access to affordable and nutrient-rich food in early childhood, appropriate maternal and child care practices, adequate health services, and a healthy environment, including access to safe water, sanitation, and good hygiene practices are the key ingredients that can free children from all forms of malnutrition [11,12].

In recent decades, numerous studies have shown gender differences in the health status of children. The studies have consistently shown boys to be advantageous over girls [13-16]. The health outcomes, including mortality rates, calories and nutrient intake and anthropometric indicators, are better among boy children. At the same time, girl children tend to have better nutritional outcomes at birth than boys due to their greater biological resilience to adverse circumstances [17,18]. However, preferential treatment of boy children concerning the intrahousehold allocation of food and health expenditures after birth improves their nutritional status in a later phase [14-16].

The current paper’s objective is to assess the nutritional status and find out the differences in the prevalence of undernutrition gender-wise. Further, it also tries to explore the variation in the estimation of undernutrition among children and suggest an appropriate method to estimate undernutrition.

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Anthropometric Measurements

The anthropometric measurements most commonly and widely used to identify the undernourished child are conventional indices, i.e. stunting (height for age Z score below -2 SD), wasting (weight for height Z score -2 SD), and underweight (weight for age Z score -2 SD) [19-21]. According to the World Health Organisation, stunting is a measure of linear growth and is an indicator of chronic undernutrition resulted from prolonged food deprivation or disease or illness. Wasting results mainly from inadequate nutrition during the period immediately before the survey and is an indicator of acute undernutrition. Whereas, underweight is a composite index that combines both chronic and acute undernutrition, reflecting either past or present undernutrition and shows the undernourished condition, which may depend on multiple causes [22]. However, these conventional indexes are not sufficient for measuring overall undernutrition among children [23]. "In 2000, Prof. Peter Svedberg suggested an alternative measure to assess overall magnitude of undernutrition, i.e. Composite Index of Anthropometric Failure (CIAF)" [21]. CIAF incorporates all undernourished children. It provides a single measure to estimate the level of undernourished children [19,20]. It categorises the nutritional status of children into seven groups, i.e. Group A, B, C, D, E, F, and Y. Group A includes no anthropometric failure. Group B denotes wasting only. Group C represents wasting and underweight. Group D denotes children who suffer from all three failures together, stunting, wasting, and underweight. Group E represents stunting and underweight. Group F includes stunting only, and Group Y denotes underweight [20,23].

Study Area

Darjeeling is the northernmost district of the state of West Bengal, India, in the foothills of the Himalayas. The strategic location of Darjeeling is very important, bordering Bhutan to the east, Nepal to the west and Sikkim to the north, thus forming an international and inter-state border area. Darjeeling is famous and popular throughout the world for producing high-quality tea. It is the people of tea gardens who are playing a major role in contributing to the states' economy, but, unfortunately, the life of these people living in the tea gardens has not yet been investigated much. Although the nutritional status of children in tea gardens of Darjeeling has not been previously studied, findings on socio-economic status in tea gardens of Darjeeling [24] suggest that the nutritional status could be low.

MATERIALS AND METHODS

A cross-sectional study was conducted in tea gardens of Darjeeling, West Bengal, India, on children aged 1 to 5 years. A total of 400 children from 10 tea gardens based on probability proportional to size sampling were surveyed. However, the children suffering from any chronic illness which influence child nutritional status are excluded from the study.

The assessment of a child's nutritional status is conducted by collecting information on a child's height, weight, and age. Children's height was measured using a non-flexible measuring tape and weight on a digital weighing scale. The magnitude of child undernutrition is estimated through conventional indices and CIAF. Conventional indices estimate undernutrition through stunting, wasting, and underweight. Based on the measurement of height, weight and age collected, Z scores were calculated, i.e. height for age Z score (HAZ), weight for height Z score (WHZ), and weight for age Z score (WAZ). Each of these indices shows a child's nutritional history compared against an international reference population developed from anthropometric data collected in the United States by the National Centre for Health Statistics (NCHS) as recommended by World Health Organisation. Here, children whose Z score measurement falls below -2 standard deviation are referred to as stunting (height for age), wasting (weight for height), and underweight (weight for age). Apart from conventional indices, the CIAF measure is also used to assess the child's nutritional status. Further, to analyse gender-wise differences in the prevalence of undernutrition, a Chi-square test is performed.

RESULTS

Nutritional Status of Children according to Conventional Indices

According to the National Family Health Survey IV (NFHS IV, 2015-16), the nutritional status of a child, i.e. stunting, wasting, and underweight in Darjeeling district was 30%, 10% and 25% which is much better than the state average, i.e. 34%, 22 % and 34% respectively. However, according to the conventional indices, calculated for the sample children and estimated according to the recommended by the World Health Organization growth standard, it has been observed that the level of undernutrition in tea gardens of Darjeeling is very high. The level of undernutrition (according to conventional indices, i.e. stunting,

Table 1: Gender-Wise Nutritional Status of Children according to Conventional Indices in Tea Gardens of Darjeeling (n=400)

Anthropometric Indicator	Boys (n=210)	Girls (n=190)	Total (n=400)	Pearson Chi-Square Test
Stunting (HAZ below -2SD)	41.4	46.3	43.8	9.68 (0.325)
Wasting (WHZ below -2 SD)	18.1	22.6	20.2	1.27 (0.260)
Underweight (WAZ below -2 SD)	35.7	36.8	36.2	0.055 (0.815)

Stunting (Height-for-age Z score below -2SD), Wasting (Weight-for-height Z score below -2 SD), Underweight (Weight-for-age Z score below-2 SD).

wasting, and underweight) is 43.8%, 20.2%, and 36.2%, respectively (Table **1**).

In the study area 52.5% (n=210) are boys and 47.5% (n= 190) are girls. The mean age of the children is 2.6 years. According to the conventional indices as recommended by the WHO growth standard, the level of stunting (41.4% boys and 46.3% girls), wasting (18.1% boys and 22.6% girls), and underweight (35.7% boy and 36.8% girl) in the study area are higher among girl child as compared to a boy (Table **1**). However, it is interesting to observe that no statistical difference exists in the prevalence of undernutrition between a boy and a girl child (Stunting $\mathbf{x^2}$=9.68, ***P***=0.325; Wasting $\mathbf{x^2}$=1.27, ***P***=0.260; Underweight $\mathbf{x^2}$=0.055, ***P***=0.815). This finding is somewhat surprising, as the analysis indicates widespread discrimination against female children [5,9,13-16,25-27]. This can be observed as a non-discriminatory treatment based on gender in the tea gardens of Darjeeling.

Nutritional Status of Children according to CIAF

CIAF classify nutritional status into 7 categories. It has been observed that 48.7% (195 children) were well-nourished in the study area, whereas more than 50% (205 children) were undernourished (Table **2**). Out of total undernourished children, 67 children (16.75%) suffer from single anthropometric failure (Group B, F, and Y). Around 83 children (20.75%) suffer from dual anthropometric failure (Group C and E), and around 54 children (13.5%) experienced multiple failures, which mean that they are stunted, wasted, and underweight at the same time. However, no significant single, double, and multiple anthropometric failure gender-wise ($\mathbf{x^2}$=0.527, ***P***=0.468) is observed in the study area (Table **2**).

DISCUSSION

The analysis indicates the high level of undernutrition in the tea gardens of Darjeeling. The secondary data NFHS round IV indicates that the level of undernutrition in the district of Darjeeling is much better than the state and India average. However, the data collected from the field survey and estimated using both the conventional indices and CIAF indicates that the level of undernutrition is very high in tea gardens of Darjeeling. The level of stunting in the study area was 43.8%, which is 14% higher than the district average and 10% higher than the state average. The

Table 2: Gender-Wise Nutritional Status of Children according to CIAF in Tea Gardens of Darjeeling (n=400)

Groups	Description of the group	Boys % (n)210	Girls % (n)190	Total % (n)400
A	No anthropometric failure	50.47 (106)	46.84 (89)	48.75 (195)
B	Wasting only	1.42 (3)	2.63 (5)	2 (8)
C	Wasting and underweight	2.85 (6)	4.21 (8)	3.5 (14)
D	Wasting, underweight and stunting	12.38 (26)	15.26 (29)	13.5 (55)
E	Stunting and underweight	17.61 (37)	17.36 (33)	17.5 (70)
F	Stunting only	10 (21)	11.57 (22)	10.75 (43)
Y	Underweight	5.23 (11)	2.10 (4)	3.75 (15)
CIAF	Composite index of anthropometric failure	49.52 (104)	53.15 (101)	51.25 (205)
$\mathbf{x^2}$	0.527			
P	0.468			

level of wasting is also 10% higher than the district average but 1% lower than the state average. However, the level of underweight is 11% and 3% higher than the district and state average. The comparison in the estimation of undernutrition according to the conventional indices and CIAF, it is evident that the CIAF could identify more undernourished children than conventional indices [20]. The prevalence of undernutrition according to CIAF was 51.2%, whereas according to the conventional indices, the level of stunting, wasting and underweight was 43.8%, 20.2%, and 36.2%, respectively. This indicates that CIAF could identify 10%, 31%, and 14% more undernourished children than stunting (HAZ), wasting (WHZ), and underweight (WAZ), respectively. The CIAF is a better tool to assess undernutrition than conventional indices [19]. The CIAF highlights the seriousness and severity of overall undernutrition in the population, unlike conventional measures that underestimate the problem of overall undernutrition in the population [21]. It does not provide a holistic picture of the overall prevalence of undernutrition. It cannot identify children with single, double, and multiple failures separately. Though the conventional indices reflect the distinct biological processes and cannot be disregarded, CIAF must be considered for policy making and monitoring tools for planning purposes [19].

However, the analysis based on the estimate of both the indices (conventional indices and CIAF) in the study indicated no significant difference in the level of undernutrition exist gender-wise. This finding contradicts the general believes that the nutritional status is better among boy children than girls [13-16,25-27]. The possible answer could be due to the recent intervention of child development programmes. Alternately, the rising level of education in general and women in particular may have eliminated the previous gender differences in child health. Besides, the data permitted only limited analysis of identifying gender differences in child nutrition and contain no information on parental attitude, education level and programmatic factor. The current paper provides scope for further research on social and programmatic aspects.

However, no differentials based on the gender on nutritional status reported here in the paper must be seen as strong positive findings. Furthermore, with more than half of the children undernourished in the study area, the paper suggests the urgent need to focus on young children's health care to remove the future burden of diet-related diseases.

CONFLICT OF INTEREST

The author has no conflicts of interest associated with the materials presented in this paper.

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