Prevalence of stunting and associated factors among public primary school pupils of Bahir Dar city, Ethiopia: School-based cross-sectional study

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Abstract

Background
Stunting is a well-established child-health indicator of chronic malnutrition, which reliably gives a picture of the past nutritional history and the prevailing environmental and socio-economic circumstances.

Objective
To investigate the prevalence of stunting and associated factors among public primary school children of the Bahir Dar city.

Method
A cross-sectional study was carried out from March to June 2019. Data were coded and entered into the Epi-Data and exported to SPSS version 23 software. The pupil was stunted if the height- for-age was \( \leq -2 \) SDs from the median growth standards according to the WHO. A descriptive summary was computed using frequency, percent, mean, median and standard deviation. A simple logistic regression model was fitted to identify associated factors between the independent variables and the dependent variable at a 95% confidence interval (CI) and p-value <0.05.

Results
370 primary school pupils were included in the study with the mean age of 10.15 (± 2.23 SD) years. 51.6% of the pupils were females. The total prevalence of stunting was 15.13% (95% CI; 11%, 19%). The burden of stunting was higher in the age group of 11 years and older.
Pupil’s age older than 11 years (AOR = 15.6; 95%CI: 3.31, 73.45; p-value < 0.001) and male sex (AOR = 7.07; 95%CI: 2.51, 19.89; p-value < 0.0002) were significantly associated with stunting.

Conclusion

The prevalence of stunting was relatively lower than the regional estimated stunting level. Older age and male sex were significantly associated with stunting.

Introduction

School children pass through great physical and mental changes, which affect both their growth and school performance [1], and nutrition is one of the many key factors affecting mental development of children [2].

Undernutrition is a condition that results from insufficient intake of energy and nutrients to meet an individual’s needs to maintain good health [3]. Undernutrition is widespread among school children in low income countries, particularly in Africa, and their nutritional status often worsens during their school years. Undernutrition greatly affects both the cognitive and physical development of school age children [4], and increases susceptibility to infection [5].

Undernutrition-related health challenges in school-age children are among the most frequent reasons for low school enrolment, high absenteeism, early dropout, poor academic performance, delayed cognitive development, short stature, reduced work capacity, and poor reproductive performance [4]. Stunting is the collective impact of glitches in socioeconomic status and persistent infections. It originates from long-term nutritional deprivation, inadequate childcare and poor environmental and social conditions [6]. It affects 165 million children worldwide, 90% of whom live in Africa and Asia [7]. Studies revealed that different countries had different figures of stunting. Globally, the prevalence of stunting among school age pupils ranges from 20 to 80% [8,9].

According to a study done in rural Ethiopia, the extent of stunting in school-age children ranges from 26.5% to 42.7% [10]. However, in urban school-age children the stunting level ranged from 5.4% to 29.2% [11]. But these reports are outdated and could not show the current situations of the stunting level.

Factors such as child age, family size, mother’s education, father’s occupation, and child’s immunization, public taps, tea drinking habit, anemia, born to a working and older mother, didn’t use a bed net, and illness of the child within the last 2 weeks have been associated with stunting [12–14].

The motive for conducting this study was to assist in the achievement of sustainable developmental goals (SDGs) through determining the stunting level and identifying the associated factors among pupils of public primary schools. These are the dragging risk factors for school dropout and may impact the target of quality primary education for all (SDGs-4) [15]. Furthermore, Previous studies were targeting on under-five stunting, and the stunting among primary school pupils were the neglected one. The other pushing reason for this study was the lack of data on the health of public primary school pupils, and the growing motives of governments and Aid agencies in the correlation of health and education.
Methods

Study design, setting and period
A school-based cross-sectional study was conducted among Bahir Dar city public primary school pupils from March 10 to June 10, 2019. Bahir Dar city is located 565 km away from Addis Ababa, the capital city of Ethiopia. Bahir Dar city is the second biggest city in Ethiopia, next to Addis Ababa [16]. Bahir Dar city is the capital city of the Amhara regional state, where the higher prevalence of stunting was observed [17]. The city includes six administrative units or sub-cities. The total population of the city is estimated to be 249,851 (estimated population and household survey of 2017/18) (124,426 females and 125,425 males) [18]. In the city, there are 19 public primary schools (1 up to 8 graded) [19].

Population, sample size determination, and sampling procedure
The source population for this study consisted of all pupils attending primary schools of the Bahir Dar city. The study population for this study was pupils attending the primary schools selected for the city. Those who were drop outs or absent during the data collection period were excluded. The sample size was determined using a single population proportion formula by considering: 95% confidence level, 5% margin of error, with the proportion of stunting of 18.3% in Bahir Dar city [20]. Taking the design effect 1.5 and 10% non-response rate, and considering the correction formula (N < 10,000), the final sample size was 375. Five primary schools were recruited from the total of 19 primary schools (grades 1 to 8) by lottery method. From the five selected schools, primary cycle (1 up to 4 graded) pupils were randomly recruited for the study. Samples were proportionally assigned to each of the selected primary schools based on the number of primary cycle students. Thus, 38, 45, 46, 103, and 138 pupils were selected from Yekatit 23, Shimbit, Misrakegion, Teyima, and Sertsedenegle primary schools, respectively, using the school attendance sheet via systematic random sampling technique [Fig 1].

Data collection procedure
Data collection tools were initially prepared in English then translated to the local Amharic language (attached in Supporting information). Six nurses with Bachelor’s degree (four for data collection and two for supervision) were recruited. Two days training was given for data collectors and supervisors by the principal investigator about the objective of the study. Socio-demographic characteristics, health care characteristics, maternal awareness on dietary diversification, and household food security related data were collected from the parents using a pre-tested structured interviewer-administered questionnaire. Anthropometric data such as weight, height, and body mass index were taken from each study participant (pupil) by removing all clothes and shoes except sensitive wears like pants and shirts and the privacy was maintained. Measuring devices used were the ones distributed to the health institutions by Ethiopian ministry of health.

After portable anthropometric measurements were taken, the parents were invited to each respective school and were interviewed face to face based on the objective of the study. Each questionnaire had an information sheet attached with instructions to ensure that all respondents received the same directions and an informed consent form for respondents to read and sign if they agreed to be part of the study.

Study variables and measurement
Stunting. The pupil was classified as stunted if the height-for-age was \( \leq -2 \) SDs from median growth standards of WHO [21].
Underweight. The pupil was classified as underweight if the weight-for-age was ≤ -2 SDs from median growth standards of WHO [21].

Wasting. The pupil was classified as wasted if the weight-for-height was ≤ -2 SDs from median growth standards of WHO [21].

Dietary diversity. Is the number of various foods or food groups consumed over a given reference period [22]. In this study, dietary diversity was achieved (responded 'yes') when the pupil consumes at least three dietary groups (cereals, vegetables, and animal products) per day.

Food security. A condition that all parents of the pupil access safe, sufficient, and nutritious food all times to meet their dietary needs [23].
Ill pupil. In this study, a pupil was considered ‘ill’ if he/she was ill within the last two weeks of the data collection period.

Quality control
The principal investigator (PI) trained the data collectors and the project investigators, who supervised the data collectors, on the goals of the project and on data quality. The enumerators and the project investigators carried out pre-test activities in a nearby town (Woreta) in five percent of the total sample size before the actual data collection. Then, vague sentences were explicitly rephrased. The internal consistency (Cronbach alpha) level of the pretest of stunting was 0.84.

Calibration of the digital weight scale (to zero) and cross-checking it using a pre-known weight material before weighing each pupil. The height of the pupil was measured after putting the pupil on the vertical wooden height measuring board. The pupil of the school was standing upright in the middle of the board. The pupil’s head, shoulders, buttocks, and heels are touching the measuring board. The height of the pupil was recorded to the nearest 0.1 cm. At the end of every data collection day, the project investigators examined each questionnaire and gave pertinent feedback to the enumerators.

Data processing and analysis
The collected data were checked for completeness and consistency. The data were cleaned, coded, and entered to EPI-Data software. The analysis was done using SPSS (Version 20) and Anthro-plus software. Descriptive statistics were computed, and the chi-square assumptions were assessed to check the presence of the relationship between two categorical variables. The model fitness was checked using Hosmer and Lemeshow goodness of fit ($P > 0.05$). A simple logistic regression model was used to identify the association between the explanatory variables and stunting. Adjusted Odds ratio (AOR) with 95% CI (confidence interval) was used to measure the strength of association between explanatory variables and the stunting.

The chi-square ($X^2$) test was checked and a $p$-value < 0.05 at $X^2$ test was considered as having relationship between predictor variables and stunting and these variables were run in to bivariate regression analysis. Then, predictor variables having a $p$-value < 0.20 at bivariate regression analysis were taken into a multivariable logistic regression analysis to see associations between dependent and independent variables. The backward logistic regression method was used, and variables with a $p$-value of < 0.05 at multivariable analysis were considered as statistically significant predictors of stunting.

Ethical considerations
Ethical approval was obtained from GAMBY Medical and Business College, Research and Publication Office with the reference number of GC-221/2011. Before the beginning of data collection, permission letter was obtained from the Amhara National, Regional Institute of Public Health prior to the data collection period. The support letter was obtained from Bahir Dar city health and education department. The school directors were informed about the purpose of the study that it will contribute to the health needs of the students. For pupils of 7–12 years old, the written consent was taken from his/her parents/guardians. For pupils of 13–17 years old, consent was secured from them only with parental/guardian permission. However, for pupil’s older than 17 years, written consent was secured solely from them. The objective of the study was clarified to the respondents and they were notified that they have the right to refuse or terminate the study at any point of the interview. The written consent and the data collection tools were documented and kept confidential in a secure place. Stunted pupils’
families were extensively advised on the importance of a balanced diet and they were referred to consult the nearby health institution for technical support for at least to halt the further complication of stunting.

**Results**

**Sociodemographic characteristics of the study participants**

A total of 370 primary school pupils was recruited for the study with a response rate of 98.6%. The mean age of the respondents was 10.15 (± 2.23 SD) years. Twelve percent of female pupils were stunted compared to 19% among male pupils. Thirty-five percent of pupils with 11 and above family size were stunted compared to 14% among five and lower family size. Twenty percent of the merchant parents’ pupil were stunted compared to 11.1% of housewife. Eighteen percent of the non-formal education attended parents’ pupil were stunted compared to 11% of secondary and above educated. Twenty percent of the 500 birrs and lower monthly earned parents’ pupil were stunted compared to 14% of 500 birrs and above. About 87% of the pupil were under-weight while nearly 41% of the pupil were wasted [Table 1].

**Household food security and dietary diversification characteristics**

About twenty-two percent (22.2%) of the stunted children were from parents who were worried about not having enough household food and sharing food when there is no enough food. About one-fifth (19%) of the stunted child’s parents thought their family did not get enough food [Table 2].

**The prevalence of stunting among primary school pupils**

This study revealed that 15.13% of the pupils of the city public primary school was stunted. The highest level of stunting happened at Sertsedengel primary school (41.1%), followed by Teyima (39.3%), Shimbet (8.9%), Yekatit 23 (7.1%), and Misrageghion primary schools (3.6%), respectively. The highest proportion of stunting in Sertsedengel primary school could be as this is found at the center of the city, where many of the poor are living, it may expose them for a higher level of stunting.

**Factors associated with stunting among primary school children**

With the multivariable logistic regression model, age and sex of the pupil were significantly associated with stunting at a p-value of 0.05.

Accordingly, those primary school children in the age group of 11 years and older were about 15 times, (AOR = 15. 6; 95%CI: 3.31, 73.45) more likely to be stunted compared to the age group of 6–8 years. Similarly, the odds of stunting among male pupils were about 7 times (AOR = 7. 07; 95%CI: 2.51, 19.89) higher compared to those female pupils [Table 3].

**Discussion**

The prevalence of stunting was 15.13% (95%CI; 11, 19). This finding was lower than the EDHS-2016 report, 38% [24]. Similarly, the current study finding is lower than other indigenous studies of Jimma Zone, 24.1% [25], Gondar town, 46.1% [26], Humbo district, 57% [27], Mecha District, 37.9% [28], Arba Minch city, 41.9% [29], and southern Ethiopia, 28% [30]. This difference might be due to, the current study was done in the Bahir Dar city, where the health information, dissemination and communication extensively distributed to the communities, and the households might be entirely aware of the nutrition related issues via different mass media, which in fact might allow the pupils get regular balanced diet as per their parents’
However, this study finding was higher compared to studies in Sudan, 3.8% - 7.1% [31,32], Nigeria, 10.5% [33], Iran, 3.7% [34], China, 1.0% - 4.7% [35–37], Pakistan, 8% [38], and Colombia, 19.8% [39]. The possible explanation for this discrepancy might be the difference in study settings, social norms, lifestyles, health care set up, and health information.
Table 2. The relationship of household food security, dietary diversification, and stunting among Bahir Dar city public primary school pupils, North West Ethiopia, 2019.

| Variable                                           | Stunted   | Not-stunted | Total   | X², p-value |
|----------------------------------------------------|-----------|-------------|---------|-------------|
| You faced food shortage                           |           |             |         |             |
| Yes                                                | 22 (15)   | 125 (85)    | 147 (39.7) | 0.005, 0.94 |
| No                                                 | 34 (15.2) | 189 (84.8)  | 223 (60.3) |             |
| You worried about not having enough household food |           |             |         |             |
| Yes                                                | 35 (22.2) | 123 (77.8)  | 158 (42.7) | 10.57, 0.001|
| No                                                 | 21 (9.9)  | 191 (90.1)  | 212 (57.3) |             |
| Frequency of worrying due to fear of not having enough household food |           |             |         |             |
| Always                                             | 10        | 27          | 37      | 8.115, 0.017|
| Usually                                            | 7         | 57          | 64      |             |
| Sometimes                                          | 18        | 39          | 57      |             |
| Your action when your family gets a shortage of food|           |             |         |             |
| Share with relatives                               | 12 (22.2) | 42 (77.8)   | 54 (14.6) | 3.69, 0.448 |
| Debt                                               | 14 (13.2) | 92 (86.8)   | 106 (28.7) |             |
| Work hard                                          | 20 (16.1) | 104 (83.9)  | 124 (33.5) |             |
| Do nothing                                         | 4 (9.3)   | 39 (90.7)   | 43 (11.6) |             |
| Asking for donation                                 | 6 (14)    | 37 (86)     | 43 (11.6) |             |
| You think your family member didn’t get enough food |           |             |         |             |
| Yes                                                | 23 (19)   | 98 (81)     | 121 (32.7) | 2.10, 0.147 |
| No                                                 | 33 (13.3) | 216 (86.7)  | 249 (67.3) |             |
| Reason for food shortage                           |           |             |         |             |
| Divorce                                            | 4 (10.8)  | 33 (89.2)   | 37 (25.2) | 7.58, 0.106 |
| Alcohol abuse                                      | 2 (8)     | 23 (92)     | 25 (17.0) |             |
| Income shortage                                    | 14 (24.1) | 44 (75.9)   | 58 (39.5) |             |
| Lack of national peace                             | 0 (0)     | 13 (100)    | 13 (8.8) |             |
| Economic instability                               | 2 (14.3)  | 12 (85.7)   | 14 (9.5) |             |
| The mother participated in child feeding           |           |             |         |             |
| Yes                                                | 44 (13.7) | 277 (86.3)  | 321 (86.8) | 3.84, 0.051 |
| No                                                 | 12 (24.5) | 37 (75.5)   | 49 (13.2) |             |
| Heard about variety of food                        |           |             |         |             |
| Yes                                                | 52 (14.8) | 299 (85.2)  | 351 (94.9) | 0.546, 0.46 |
| No                                                 | 4 (21.1)  | 15 (78.9)   | 19 (5.1) |             |
| Sources of information                             |           |             |         |             |
| Health care provider                               | 22 (13.8) | 138 (86.3)  | 160 (45.6) | 5.25, 0.154 |
| Family members                                     | 5 (8.1)   | 57 (91.9)   | 62 (17.7) |             |
| Television                                         | 17 (23.0) | 62 (77.0)   | 79 (22.5) |             |
| Radio                                              | 8 (21.4)  | 42 (78.6)   | 50 (14.2) |             |
| Variety of food is good for your children           |           |             |         |             |
| Yes                                                | 55 (15.1) | 309 (84.9)  | 364 (98.4) | 0.011, 0.92 |
| No                                                 | 1 (16.7)  | 5 (83.3)    | 6 (1.6) |             |
| Place you will take when your child gets sick      |           |             |         |             |
| Health institution                                 | 39 (14.8) | 225 (85.2)  | 264 (71.4) | 1.49, 0.474 |
| Traditional medicine                               | 4 (10.5)  | 34 (89.5)   | 38 (10.3) |             |
| Holly water                                        | 13 (19.7) | 55 (80.3)   | 68 (18.4) |             |
| Any chronic disease** in the family                |           |             |         |             |

(Continued)
dissemination. Pupil’s age of 11 years and older were about sixteen times more likely to be stunted than the age group of 6 up to 8 years. This finding was supported by studies in Ethiopia [7,12,14,40], Tanzania [41], Nigeria [42,43], Iraq [44], Pakistan [38,45] Angola [5], and Indonesia [46]. This could probably be due to older children are in the transition life stage to adolescence when several unique challenges, including an increased body requirement for nutritional need are observed [47]. This also reveals that stunting is a long-lasting nutritional deprivation, developed a long period of time and hard to reverse once originated. The other possibility could be, nearly two-third of mothers were not attended formal education. These mothers might wrongly perceive, the older children get grown and wouldn’t be stunted.

Male primary school pupils were sevenfold at higher risk of stunting than females; which was supported by studies from the Ethiopia [14,48] and Tanzania [41]. In contrast, Studies

Table 2. (Continued)

| Variable                                              | Stunted N (%) | Not-stunted N (%) | Total N (%) | X², p-value |
|-------------------------------------------------------|---------------|-------------------|-------------|-------------|
| Yes                                                   | 6 (17.6)      | 30 (83.3)         | 36 (16.7)   |             |
| No                                                    | 50 (15.0)     | 284 (85.0)        | 334 (83.3)  | 0.073, 0.78 |
| The current health status of this pupil               |               |                   |             |             |
| Ill                                                   | 4 (15.0)      | 20 (85.0)         | 24 (6.5)    |             |
| Healthy                                               | 52 (16.7)     | 294 (83.3)        | 346 (93.5)  |             |

* (eating food at least three times per day); chronic disease
** (diabetes mellitus, hypertension and/or asthma).

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Table 3. Simple logistic regression analysis on factors associated with stunting among Bahir Dar city public primary school pupils, North West Ethiopia, 2109.

| Variable                                              | Stunting N (%) | No (N) | COR (95%CI)     | AOR (95%CI)   | P-value |
|-------------------------------------------------------|----------------|--------|-----------------|---------------|---------|
| Age of the pupil (in years)                           |                |        |                 |               |         |
| 6–8                                                   | 7              | 90     | 1.00            | 1.00          |         |
| 9–10                                                  | 14             | 116    | 1.55 (0.6,4.0)  | 4.44 (0.88,22.34) | 0.070   |
| ≥ 11                                                  | 35             | 108    | 4.17 (1.76,9.83) | 15.6 (3.31,73.45) | 0.001   |
| Family size                                           |                |        |                 |               |         |
| 1–5                                                   | 27             | 172    | 1.00            | 1.00          |         |
| 6–10                                                  | 22             | 129    | 1.08 (0.59,1.99) | 1.83 (0.72,4.67) | 0.199   |
| 11–15                                                 | 7              | 13     | 3.43 (1.26,9.36) | 2.95 (0.43,19.81) | 0.266   |
| Worring due to fear of not having enough household food|                |        |                 |               |         |
| Yes                                                   | 35             | 123    | 2.58 (1.44,4.65) | 1.21 (0.43,3.43) | 0.717   |
| No                                                    | 21             | 191    | 1.00            | 1.00          |         |
| Frequency of worry due to fear of not having enough household food |                |        |                 |               |         |
| Always                                                | 10             | 27     | 1.00            | 1.00          |         |
| Usually                                               | 7              | 57     | 0.33 (0.11,0.96) | 0.45 (0.13,1.25) | 0.116   |
| Sometimes                                             | 18             | 39     | 1.24 (0.49,3.11) | 1.75 (0.64,4.79) | 0.274   |
| Sex of the pupil                                       |                |        |                 |               |         |
| Female                                                | 22             | 169    | 1.00            | 1.00          |         |
| Male                                                  | 34             | 145    | 1.80 (1.00,3.21) | 7.07 (2.51,19.89) | 0.0002 |

COR: Crude Odds Ratio; AOR: Adjusted Odds Ratio; P-value: probability value.

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from China [49], and Pakistan [50] revealed that females were more likely to be at risk than males. This might be males’ growth and development is more influenced by environmental and nutritional stress than females and thus, making males more likely to be affected by stunting [4]. This is also common and culturally known in Ethiopia that females are obliged to go home after school as they intend to learn in-home activities and to shoulder the responsibilities and share their mother’s home task. While the males are supposed to exercise, outdoor activities; like football playing and swimming at the river. And they might not give attention to the diet if they are not at home during the feeding time. It is also known that boys are known to have higher risk of stunting due to higher zinc requirement to meet their higher growth rate [51,52].

Age of the pupil and stunting has a positive correlation as age advances, the likelihood of being stunted increases. Similarly, male pupils are at high risk of being stunted due to different nutrient deficiencies [51,52]. Therefore, the Ethiopian ministry of health and education should give due attention to Zink supplementation, and school feeding should be a primary target of programs aiming at preventing stunting.

Limitations of the study
The study was cross-sectional and thus cannot confer a causal relationship. We didn’t collect the morbidity and health services utilization data as the UNICEF conceptual framework considers these components for under-nutrition assessment. There might also be a potential bias Measurement bias might also occur, as not having a standardized height measurement. However, the data collectors trained on how to measure and pupils were removing all clothes and shoes except pants and shirts, which helped us to reduce the measurement bias.

Conclusion
The prevalence of stunting was 15.13%, and the pupil’s age and sex were significantly associated with stunting. Therefore, this finding alerts the need to implement school health and nutrition programs to improve the nutritional status of school-age children in Bahir Dar city. The ministry of health and the respective zonal education department should strengthen and rapidly expanding the coverage of the school feeding program (Seqota declaration) to the city’s primary schools to improve school children’s health and nutrition status and to increase access to education. It is advisable to give Zink supplementation for male pupils and older age pupils. It is good to take due attention to extensively creating awareness of stunting and its consequences to the public primary school pupils by the health care workers, and through mass media to enhance the parents/caregivers’ understanding of undernutrition. Besides, large scale studies like the national nutritional surveys should contemplate school-age children as one element to evaluate their nutritional status regularly.

Supporting information
S1 File. Supporting information 2 (English version questionnaire).
(PDF)

S2 File. Supporting information 3 (SPSS data).
(SAV)
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