Predictors of Chronic Under Nutrition (Stunting) Among Children Aged 6-23 Months in Kemba Woreda, Southern Ethiopia: A Community Based Cross-Sectional Study

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Abstract
Background: Stunting is a public health problem in developing countries. Stunting (deficit in height/length for age of at least -2 Z score) affects close to 195 million children under five years of age in the developing world. Stunting is a major cause of disability preventing children who survive from reaching their full developmental potential.

Objective: To assess chronic under nutrition (Stunting) and associated factors among Children aged 6-23 months in Southern Ethiopia.

Methods: Community based cross-sectional study was carried out among 562 mothers who have young children from 6-23 months in 2014/15 in Kemba Woreda by using pre tested and structured questioners. Bivariant and multivariate analyses were conducted by SPSS version 20 and finally result was interpreted, compared and discussed with different recently published scientific journal.

Results: The study revealed that out of 562 children, 18.7%; 95% C.I (15.6-22.1) of children were stunted, or chronically undernourished (i.e. HAZ ≤ 2Z-score). In multiple logistic regressions, boys [AOR: 2.50; 95% CI(1.60-4.01)], older mothers [AOR: 2.60; 95% CI (1.07-6.35)], mothers who have no formal education [AOR: 2.76; 95% CI (1.63-4.69)], mothers who work as daily workers [AOR: 3.06; 95% CI (1.03-9.12)] and have Private work activity(merchant, farmers) [AOR: 2.39; 95% CI (1.61-3.53)], mothers who have no post natal follow up [AOR: 1.64; 95% CI (1.05-2.55)] and maternal illness encountered after delivery [AOR: 1.56; 95% CI (1.05-2.32)] were identified as significant independent predictors of childhood stunting.

Conclusion and Recommendation: A significant number of young child develop chronic malnutrition in this critical periods. Stunting was significantly associated with the illiterate mothers, mothers who work as daily workers and Private work, those has no post natal follow up and maternal illness encountered after delivery. An organized effort should be made at all levels to solve the problems of chronic under nutrition (stunting) in children.

Keywords: Stunting; South Ethiopia; Kemba Woreda

Abbreviations: AOR: Adjusted Odd Ratio; SAM: Sever Acute Malnutrition; MUAC: Mid-Upper-Arm Circumference; CI: Confidence Interval; SD: Standard Deviation; TFU: Therapeutic Feeding Unit

Introduction
Poor linear growth, or stunting (low length- or height-for-age), in young children is the result of multiple circumstances and determinants, including antenatal, intra-uterine and postnatal malnutrition, more commonly due to inadequate or inappropriate nutrition and the impact of infectious disease. Childhood stunting continues to be a public health issue in many African countries [1,2].

Stunting in early life is associated with adverse functional consequences and growth failure during infancy and early childhood is often irreversible, leading to short stature during adolescence and adulthood. Stunting is associated with an elevated risk of child mortality, increased susceptibility to infection and poor cognitive and psychomotor development. The long-term consequences of stunting include deficits in school achievement, reduced work capacity and adverse pregnancy outcomes. Worldwide, stunting affects nearly one-third of children under 5 years of age, with the prevalence being higher in low-resource countries in sub-Saharan Africa and South Asia [3-5]. Stunting is a multi-factorial phenomenon with a high prevalence in developing countries [6]. Globally, it is estimated that under nutrition is responsible, directly or indirectly, for at least 35% of deaths in children less than five years of age. Stunting (deficit in height/length for age of at least -2 z score) affects close to 195 million children under five years of age in the developing world [7].

Appropriate weaning and complementary feeding behaviors, nutritional interventions, and disease control and treatment programs are strategies to prevent stunting. However, their effectiveness also depends on counteracting the environmental and socio-economic circumstances that allow infection and sub-optimal nutrition to persist [1,6].

The period from birth to two years of age is particularly important because of the rapid growth and brain development that occurs during...
this time. The period is often marked by growth faltering, micronutrient deficiencies and common childhood illnesses [8].

Infant-feeding practices constitute a major component of child caring practices apart from socio-cultural, economic and demographic factors. Somehow, these practices constitute one of the most neglected determinants of young child malnutrition in spite of their important role in growth pattern of children [9].

Data exists in Ethiopia that show the problem of malnutrition beginning early in life, primarily during the first 12 months when growth faltering takes hold due to sub-optimal infant feeding practices. Stunted infants grow to be stunted children and stunted adults [10]. At national level, 44% of children under age five are stunted and 21% of children are severely stunted [11]. In order to effectively accomplish the goals of accelerated Stunting reduction, identifying the potential determinants of chronic under nutrition is a vital step to reduce the burden of stunting. Therefore, the aim of this study was to have detailed and concrete data that fill these gaps and would add a value that directs policy makers to draw appropriate intervention measures to improve and flourish the health of future generation.

Methods and Materials

Study setting and source population

This community based cross-sectional study was carried out from December 7-27/2014 on 562 mothers who has young child from 6 months to 2 years age in Kemba Woreda located in Southern parts of Ethiopia. The Southern Nations Nationalities and People’s Regional State (SNNPRS) consists of 13 zones and 104 woreda. The region has an estimated 15,042,531 (20.4% of the national estimate) people. Close to 90% of the population are estimated to be rural inhabitants, while 1,545,710 or 10.3% are urban. Kemba woreda is one of the administrative woreda in Gamo Gofa Zone, South Ethiopia 100 km away from Zonal town Arba Minch. From the total population around 44,000 are women in reproductive age group. The Health institution distribution in the woreda is 39 health posts and 9 health centers providing health services including maternal and child health care.

Inclusion and exclusion criteria

Mothers/care givers who have young children from 6 months to 23 months old who live in the selected Kebele for at least 6 months were included in the study and those who had mental illnesses interfering the interview were not considered in study.

Sample size determination and sampling methods

The sample size was determined by using single population proportion formula by the following assumption for prevalence of stunting (chronic malnutrition) as 44% in SNNPR, Southern Ethiopia [12], desired precision (d) as 5% and 95% as confidence interval.

\[
N = \left( \frac{Z_{\alpha/2}}{x} \right)^2 \frac{p(1-p)}{d^2}
\]

The final sample size was calculated by taking 1.5 as design effect which is 567.

Sampling methods

Interviewed mothers were selected from eight kebeles which selected by using lottery method from all kebeles. Then the number of study participant was allocated for each Kebele based on proportional to population size allocation methods by using community based demographic and health related information registration prepared by health extension workers as the sampling frame. Random censuses were conducted first to identify the target household. Finally infant-mother pairs were selected from each Kebele by using simple random sampling methods after giving code for each household which has young child from six months to 24 months.

Data collection methods, measurement and quality control

Data was collected from Mothers/care givers who have one child in age 6 months-2 years from each household by direct interviewing. Pre-tested structured questionnaire adapted from different literature was used to collect socio-demographic and others variables. The questioners were arranged and grouped according to the issue addressed. First the questioners was prepared in English and translated to Amharic and pre tested on 5% of mothers before actual data collection outside the selected kebeles; correction and modification was done based on the gap identified during interview. Six Grade 12 completed students were recruited as data collectors and supervised by 3 Nurse. Three day training was given on the aim of the research, content of the questionnaire, and how to conduct interview for data collectors and supervisor to increase their performance in field activities. The Collected data were checked every day by supervisors and principal investigator for its completeness and consistency.

Anthropometric measurements such as weight and height were measured using standard technique and calibrated equipment. The weight of each child was taken by using digital scale wearing light cloth, checking the calibration using 2 kg rod during each instant of weight measuring and the measurement was approximated to the nearest 10 g. Children were not in fasting condition and each subject was weighted twice and the average weight was taken. Length was measured in recumbent position using sliding board by two data collectors and taken to the nearest 1 mm [2,13,14]. The data collectors were trained efficiently on how to take the anthropometric measurements.

Data analysis and management

Data was coded and entered in to Epi-Info version 3.5.1 and exported to SPSS Version 20 for analysis. Exploratory data analysis was done to check missing values, potential outliers and the normality distribution for those continuous variables. The presence of multicollinearity also was checked and effort was made to incorporate different models to cross check. Anthropometric index (HAZ) was analyzed by using WHO Anthro software version 3.2.2 and categorized as stunted if HAZ ≤ -2 SD and as normal if HAZ ≥ -2 Z score; stunting is defined as HAZ ≤ -2 SD [13]. Extreme outlier of ≤ 6 Z score of HFA was omitted from the analysis. Descriptive frequencies were calculated to describe the study population in relation to relevant variables. Bivariate logistic regression analysis was calculated to assess the crude association between dependent and independent variables. Finally variables which shows association in bivariate logistic regression analysis and have P-value less than 0.25 (not to miss some of important variables that are not significant in the bivariate analysis) were entered in to Multivariate logistic regression model, to identify significant independent predictors of stunting and to control the possible effect of confounding. Variables with P-value less than 0.05 were identified as significant predictors of stunting.

Ethical consideration

Ethical clearance was obtained from Research ethics committee
(REC) of Addis continental institute of Public Health. Permission letter was obtained from Kemba Woreda Health office. Verbal informed consent from each study participant was obtained after clear explanation about the purpose of the study. All the study participants were reassured that only anonymous data were taken. They were given the chance to ask anything about the study and made free to refuse or stop the interview at any moment they want if that was their choice.

Results

Socio-demographic characteristics of the mothers and young child

A total of 562 women having young child aged 6 months to 23 months were interviewed in the study from 567 sampled mothers with 99.11% response rate. The overall mean age of young child 13.82 months ± 5.85 (SD), 53% were in age range from 6 months to 1 years and 273 (48.6%) were male and 289 (51.4%) were female with sex ratio of 0.94. Almost half of the mothers, 271 (48.2%) were in age range 25-29 years. About one third of respondents (30.8%) were have no formal educational and 46% of them were farmers and daily workers in there occupational statues. About two third of the respondent mothers 348 (61.9%) were protestant followers and rest were orthodox and Muslims (Table 1).

Prevalence of chronic under nutrition (Stunting)

From 562 interviewed mothers-child pair 18.7%; 95% C.I (15.6-22.1) of children had chronic under-nutrition (i.e. HAZ ≤ 2Z-score) of which 25.8%; 95% C.I (20.8-31.4) were boys and 12.5%; C.I (8.5-16.0) were girls. The level of moderate stunting was 10.4%; C.I (7.9-12.9); among all boys, 14.4%; 95% CI (10.2-18.6) boys and among all girls, 6.8%; 95%; C.I (3.9-9.7) girls had moderate chronic under-nutrition. The prevalence of severe stunting (HAZ ≤ 3 Z-score) was 8.4%; 95% C.I (6.1-10.7). In the overall scenario, boys were more affected than girls. There were higher numbers of stunted boys than stunted girls (Figure 1).

Factors associated with chronic under nutrition (Stunting)

After conducting Multivariate logistic regression analysis boys [AOR: 2.50; 95% CI (1.60-4.01)], age of mothers those in age group ≥

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency (n=562)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of child</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-8 months</td>
<td>125</td>
<td>22.2</td>
</tr>
<tr>
<td>9-12 months</td>
<td>172</td>
<td>30.6</td>
</tr>
<tr>
<td>13-17 months</td>
<td>119</td>
<td>21.2</td>
</tr>
<tr>
<td>18-23 months</td>
<td>146</td>
<td>26</td>
</tr>
<tr>
<td>Sex of child</td>
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<td></td>
</tr>
<tr>
<td>Male</td>
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<td>48.6</td>
</tr>
<tr>
<td>Female</td>
<td>289</td>
<td>51.4</td>
</tr>
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<td>Residence of mother</td>
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<td></td>
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<tr>
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<td>36.5</td>
</tr>
<tr>
<td>Urban</td>
<td>357</td>
<td>63.5</td>
</tr>
<tr>
<td>Age of mother</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-19</td>
<td>97</td>
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<tr>
<td>20-24</td>
<td>165</td>
<td>29.4</td>
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<tr>
<td>25-29</td>
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<td>&gt;=30</td>
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<td>3</td>
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<td>30.8</td>
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<tr>
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<tr>
<td>Daily laborer</td>
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<td>3.6</td>
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<tr>
<td>Private (merchant, farmers)</td>
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<td>46.1</td>
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<tr>
<td>Government worker</td>
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<td>Housewife</td>
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<td>45.6</td>
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<tr>
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<td>Gamo &amp; Gofa</td>
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<td>87.4</td>
</tr>
<tr>
<td>Wolaita</td>
<td>58</td>
<td>10.3</td>
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<tr>
<td>Amhara</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Table 1: Socio-demographic characteristics of mothers, who had infant aged from 6-23 months, who live in Kemba Woreda, 2014/15.

Figure 1: Schematic presentation of sampling procedure in Kemba Woreda, Southern Ethiopia, 2014/15.
30 years AOR (2.60; 95% CI (1.07-6.35), education level those who have no formal education AOR 2.76 (1.63-4.69), occupational of mothers those who work as daily workers AOR 3.06 (1.03-9.12) and private work activity (merchant, farmers) AOR 2.39 (1.61-3.33), mothers who have no post natal follow up for their child AOR 1.64 (1.05-2.55), and maternal illness encountered after delivery AOR 1.56 (1.05-2.32) were significantly associated with chronic under nutrition. However, variables such as place of residence, place of delivery and ANC follow up did not show statistical association with chronic under nutrition (Table 2).

### Discussion

The result of this study showed that the prevalence of stunting (HAZ ≤ 2SD) was 18.7% (95% CI 15.6-22.1). Boys were more likely to be stunted than girls (25.8% vs. 12.5%). The prevalence of stunting in this setting was much lower than findings from different parts of Ethiopia (Bule Hora (47.6%), Jimma arjo (41.4%) [14] and even lower than the regional stunting levels of Ethiopian demographic and health surveillance report [11], Eastern Kenya (33.3%) [15]. This finding was consistent with finding from Johannesburg (18%) [16]. In contrast to the above findings, the magnitude of stunting in the our study area was higher than report from Latin America and Caribbean countries (11%) [17]. The reason why the finding in our setting is lower than the others may be due the narrowing of age of children in the study make the magnitude of stunting is declined as compared to studies having wide target children (<5 years of age). The reason is goes in line with findings from Eastern Kenya that shows stunting is more prevalent in children >2 years [15].

In this study, child sex, maternal age, maternal educational level and occupational status, post natal follow up and were statistically significant with chronic under nutrition. Having no formal education of mothers and older mothers (>31 years) were negatively associated with the nutritional status of children. Similarly the findings are supported with findings from Johannesburg, Tanzania and Kenya.

<table>
<thead>
<tr>
<th>Explanatory Variable</th>
<th>Chronic Nutritional statuses</th>
<th>Crude OR (95% CI)</th>
<th>Adjusted OR (95% CI)</th>
<th>P-value</th>
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<td>Residence</td>
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<tr>
<td>Rural</td>
<td>159 (77.6)</td>
<td>46 (22.4)</td>
<td>1.50 (1.04-3.33)</td>
<td>1.34 (0.82-2.19)</td>
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<td>298 (83.5)</td>
<td>59 (16.5)</td>
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<tr>
<td>Male</td>
<td>204 (74.2)</td>
<td>69 (25.8)</td>
<td>2.43 (1.56-3.80)</td>
<td>2.50 (1.60-4.01)</td>
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<td>253 (87.5)</td>
<td>36 (12.5)</td>
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<td>1</td>
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<td>Age of mother</td>
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</tr>
<tr>
<td>&lt;=19</td>
<td>74 (76.3)</td>
<td>23 (23.7)</td>
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<td>20-24</td>
<td>144 (87.3)</td>
<td>21 (12.7)</td>
<td>1.03 (0.60-1.74)</td>
<td>1.15 (0.647-2.08)</td>
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<td>25-30</td>
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<td>53 (20.7)</td>
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<td>=&gt;31</td>
<td>36 (81.8)</td>
<td>8 (18.2)</td>
<td>1.96 (0.94-4.09)</td>
<td>*2.60 (1.07-6.35)</td>
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<td>Maternal Education level</td>
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<td>102 (75.6)</td>
<td>33 (24.4)</td>
<td>3.08 (1.98-4.79)</td>
<td>*2.76 (1.63-4.69)</td>
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<td>47 (19.1)</td>
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<td>25 (13.8)</td>
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<tr>
<td>Daily laborer</td>
<td>16 (72.7)</td>
<td>6 (17.3)</td>
<td>3.55 (1.40-9.09) 0.41 (0.28-0.59)</td>
<td>*3.06 (1.03-9.12)</td>
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<td>216 (80.9)</td>
<td>51 (19.1)</td>
<td>0.34 (0.12-0.96)</td>
<td>*2.39 (1.61-3.53)</td>
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<td>Government worker</td>
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<td>4 (11.8)</td>
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<td>56 (21.4)</td>
<td>1.91 (1.35-2.69)</td>
<td>0.86 (0.53-1.39)</td>
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<td>Home</td>
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<td>ANC follow up</td>
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<td>404 (81.3)</td>
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<td>325 (80.2)</td>
<td>80 (19.8)</td>
<td>1.80 (1.48-3.2)</td>
<td>**1.64 (1.05-2.55)</td>
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<td>Yes</td>
<td>19 (79.2)</td>
<td>5 (20.8)</td>
<td>1.40 (0.99-1.96)</td>
<td>**1.56 (1.05-2.32)</td>
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<td>No</td>
<td>437 (81.4)</td>
<td>100 (18.6)</td>
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</table>

**Significant factors**

Table 2: Factors associated with stunting among mothers who have 6-23 months of young child in Kembaworeda in 2014/15.
Having maternal illness and not attending post natal care were also independent predictors of stunting.

**Strength and weakness of the study**

This study is community based it show real nutritional condition of children 6-23 months of age. Thus it has strong generalization power because others study conducted with relatively small sample size and institutional based. Recall bias may be introduced even if it was minimized by probing mothers to report by association with different life events may not remember events occurred in the past, and possibility of interviewer bias and misreporting of events were the potential limitation. Another limitation of the study was failing to incorporate wealth index, dietary diversity and house hold food security (Figure 2).

**Conclusion and Recommendation**

A significant number of young children were affected by chronic malnutrition. Stunting was significantly associated with child sex, maternal illiteracy, mothers who work as daily workers and Private work, those has no post natal follow up and maternal illness encountered after delivery. An organized effort should be made at all levels to improve maternal education, post natal care practice and maternal health statuses to solve the problems of chronic under nutrition (stunting) in children, especially in this critical periods to avoid its effect on future development of young children. Appropriate and early intervention should be design at health facility and community level to improve maternal education, post natal care practice and possibility of interviewer bias and misreporting of events were the potential limitation. Another limitation of the study was failing to incorporate wealth index, dietary diversity and house hold food security (Figure 2).

**Acknowledgment**

We would like to thank Arba Minch University for funding of our research work. Our deepest gratitude goes to data collectors, kebeles leaders and Kemba woreda Health center manager for his cooperation starting from the beginning till the end of data collection time.

**Conflict of Interest**

The authors declare that they have no computing interest.