Prevalence and associated factors of zinc deficiency among high school adolescents in Gambella town, Southwest Ethiopia, 2015
Content

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• Objectives
• Methodology
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Introduction

– Adolescents stood about 1.2 billion in 2011 constituting 18% of the total world population.
  
  (World Population Day, 2013)

– They are considered to be a nutritionally vulnerable

– Globally 60-80% of them suffer from MNDs
  
  (Hettiarachchi M et.al, 2006).

– Adequate Zn nutrition is essential for health b/c zinc’s critical structural & functional roles in multiple enzyme systems
  
  (Brown K et.al 2002 & Kong A et.al 2005).
Introduction

- Zn deficiency is a **major public** health problem in many developing countries.
  
  *(Tielsch JM, et.al 2007 and Chandyo RK et.al 2009).*

- **Nearly half** of the world’s population is **at risk** due to **inadequate Zn intake**. *(Brown K et.al 2002)*

- Zn deficiency is associated with **Poor growth**, Increased susceptibility to infections.

  *(Fesharakinia AZ et.al 2009 & Prasad AS)*

- In most areas of Ethiopia consumption of **animal sources** is mostly limited to occasional public holidays, which indicated **minimal intake**

  *(Getahun Z, et.al.)*
Introduction

– Adolescents have not been considered as a high risk group for poor nutrition in developing world.

– Nutrition related efforts in the country put much emphasis on early childhood and pregnancy & lactation.

– Information regarding adolescents’ nutritional status is scarce and/or not available from Ethiopia.

– This research play a vital role in providing baseline data.
Objectives

General objective

– To assess prevalence and associated factors of zinc deficiency among high school adolescents in Gambella town

Specific objectives

1. To determine the prevalence of zinc deficiency among high school adolescents in Gambella town.

2. To identify factors associated with zinc deficiency among high school adolescents in Gambella town.
Methodology

Study Area

– The study was conducted in Gambella town.
– The region has largely hot climatic zones.
– According to the National 2007 census the region has 39,022 adolescent
– 9,843 was living in Gambella town.
Methodology...

Study design and period

– An institution based cross-sectional quantitative study design was conducted from April 1-9/2015.

Populations

Source population

– All high school adolescents residing in Gambella town

Study population

– All high school adolescents in Gambella town attending school.
Methodology...

Variables

1. Dependent variable
   – Prevalence of zinc deficiency

2. Independent variables
   – Socio-demographic factors
   – Anthropometric indices of the participant
   – Health status: Diarrhea and Malaria
   – Dietary intake of the participant
Methodology...

Operational definition

- **Zinc deficiency**: serum zinc level of < 70 µg/dL
- **Stunting**: Height for age < -2 Z scores
- **Thinness/wasting**: - < -2SD of BMI-for-age z score.
- **Underweight**: BMI for age below 5th percentile.
- **Normal weight**: BMI for age between 5th and 85th percentile.
- **At risk of Overweight**: BMI for age between 85th and 95th percentile.
Methodology...

**Sample size determination**

– **Single population proportion** formula was used

– The following assumptions were considered:

  • $P = 50$

  • Level of significance to be 5% ($\alpha = 0.05$), and $Z \alpha/2 = 1.96$

  • Absolute precision or margin of error to be 5% ($D = 0.05$).

– The final sample size was **346**
Methodology...

Sampling technique and sampling procedure

- Proportional allocation was made for the high schools
- After grade 9 & 10 students was merged their list was prepared alphabetically.
- Finally the sample size was selected by simple random sampling using student’s lists by CG sampling method.
Methodology...

Data collection procedures

a. Data collection instrument

– A pretested structured self administered questionnaire.

Anthropometric assessment

– Beam balance for Wt

– Standiometry for Ht
Methodology...

a. Data collection instrument...

Blood sample collection

- **About 5ml** of venous blood was obtained
- **Cold chain** was used to transported sample to the laboratory.
- Then serum was separated at Gambella Hospital

b. Data collectors

- HEWs for anthropometric measurement
- Laboratory technologists for blood collection.
Methodology...

Data management and analysis

– Data was **coded** and **entered** in to Epi - Info and exported to SPSS for farther analysis.

– Binary logistic regressions were employed

– Strength of associations was presented using OR with 95% CI.
Methodology...

- Ethical clearance was obtained from ERC of IPH, UoG.
- Permission from GRHB, GREB and School principal was also obtained.
- Data were collected after written consent and assent.
Result and Discussion

Socio-demographic characteristics of the participants

- The overall response rate was about 87.28%.
- Of these 302 high school adolescents 47.4% were females.
- The mean age of the study participants’ was 17.17 ±1.15
- Nearly half (49.3%) of them were orthodox in religion.
- The average family size of the study subjects was 5.21±1.52
Table-1: Socio-demographic characteristics of high school adolescents in Gambella town April 2015

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex (n=302)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>159</td>
<td>52.6</td>
</tr>
<tr>
<td>Female</td>
<td>143</td>
<td>47.4</td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
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<tr>
<td>Single</td>
<td>298</td>
<td>98.7</td>
</tr>
<tr>
<td>Married</td>
<td>3</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Residence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>300</td>
<td>99.3</td>
</tr>
<tr>
<td>Rural</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nine</td>
<td>183</td>
<td>60.6</td>
</tr>
<tr>
<td>Ten</td>
<td>119</td>
<td>39.4</td>
</tr>
<tr>
<td><strong>Religion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orthodox</td>
<td>149</td>
<td>49.3</td>
</tr>
<tr>
<td>Protestant</td>
<td>103</td>
<td>34.1</td>
</tr>
<tr>
<td>Muslim</td>
<td>40</td>
<td>13.2</td>
</tr>
<tr>
<td>Catholic</td>
<td>10</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
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<td></td>
</tr>
<tr>
<td>Oromo</td>
<td>82</td>
<td>27.2</td>
</tr>
<tr>
<td>Amara</td>
<td>64</td>
<td>21.2</td>
</tr>
<tr>
<td>Tigre</td>
<td>36</td>
<td>11.9</td>
</tr>
<tr>
<td>Agnuak</td>
<td>45</td>
<td>14.9</td>
</tr>
<tr>
<td>Nuer</td>
<td>27</td>
<td>8.9</td>
</tr>
<tr>
<td>Kambata</td>
<td>21</td>
<td>7.0</td>
</tr>
<tr>
<td>Others</td>
<td>27</td>
<td>8.9</td>
</tr>
<tr>
<td><strong>Wealth status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>88</td>
<td>29.1</td>
</tr>
<tr>
<td>Middle</td>
<td>92</td>
<td>30.5</td>
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<tr>
<td>High</td>
<td>112</td>
<td>40.4</td>
</tr>
</tbody>
</table>
Result and Discussion

<table>
<thead>
<tr>
<th>Table 5.1: - Socio-demographic characteristics ... continued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
</tr>
<tr>
<td><strong>Fathers education (n=245)</strong></td>
</tr>
<tr>
<td>Illiterate</td>
</tr>
<tr>
<td>Read &amp; write only</td>
</tr>
<tr>
<td>Grade 1-4</td>
</tr>
<tr>
<td>Grade 5-8</td>
</tr>
<tr>
<td>Grade 9-12</td>
</tr>
<tr>
<td>&gt;Grade 12</td>
</tr>
<tr>
<td><strong>Fathers occupation (n=245)</strong></td>
</tr>
<tr>
<td>Unemployed</td>
</tr>
<tr>
<td>Gov't employed</td>
</tr>
<tr>
<td>NGOs employed</td>
</tr>
<tr>
<td>Self employed</td>
</tr>
<tr>
<td>Others</td>
</tr>
<tr>
<td><strong>Mothers education (n=260)</strong></td>
</tr>
<tr>
<td>Illiterate</td>
</tr>
<tr>
<td>Read &amp; write only</td>
</tr>
<tr>
<td>Grade 1-4</td>
</tr>
<tr>
<td>Grade 5-8</td>
</tr>
<tr>
<td>Grade 9-12</td>
</tr>
<tr>
<td>&gt;Grade 12</td>
</tr>
<tr>
<td><strong>Mothers’ Occupation (n=260)</strong></td>
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<tr>
<td>Unemployed</td>
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<tr>
<td>Gov’t employed</td>
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<tr>
<td>NGOs employed</td>
</tr>
<tr>
<td>Self employed</td>
</tr>
<tr>
<td>Others</td>
</tr>
</tbody>
</table>

**Others**

**Ethnicity: - Wolayita, Hadiya, Gurage, Kafa, Sheka and Silte**

**Occupation: - Day laborer, Merchant, carpenters**
Result and Discussion

Prevalence of Zinc Deficiency

- The overall prevalence of zinc deficiency was 9.6% [95% CI: 6.3-12.9]
- **Sudan** & **Iran** reported 9% and 7.9% respectively.
  (Best C. et.al, 2010 & Dehghani SM.et.al 2011)
- This might be due to similarity in **feeding habit** with **Sudan**.
- **Soil zinc level** may be responsible factors but it warrant farther investigations
Result and Discussion

• Bivariate and multivariate logistic regression model of factors associated with zinc deficiency among high school adolescents in Gambella town 2015.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Zinc Deficiency</th>
<th>Adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Malarial history (n=302)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>14</td>
<td>49</td>
</tr>
<tr>
<td>No</td>
<td>15</td>
<td>224</td>
</tr>
<tr>
<td>DDS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lowest</td>
<td>19</td>
<td>79</td>
</tr>
<tr>
<td>Medium</td>
<td>7</td>
<td>138</td>
</tr>
<tr>
<td>Highest</td>
<td>3</td>
<td>56</td>
</tr>
<tr>
<td>PA levels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inactive</td>
<td>2</td>
<td>38</td>
</tr>
<tr>
<td>Insufficiently active</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>Active</td>
<td>9</td>
<td>91</td>
</tr>
<tr>
<td>Highly active</td>
<td>13</td>
<td>94</td>
</tr>
<tr>
<td>HAZ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stunted</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>Not stunted</td>
<td>23</td>
<td>255</td>
</tr>
<tr>
<td>Wealth status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>15</td>
<td>73</td>
</tr>
<tr>
<td>Medium</td>
<td>10</td>
<td>82</td>
</tr>
<tr>
<td>High</td>
<td>4</td>
<td>118</td>
</tr>
</tbody>
</table>

Meat intake and mothers education were controlled
Result and Discussion

History of malaria in the last 2wks

- About 21% of the participants had Hx of malaria in the 2weeks.
- About 22% of participants with Hx of malarial were zinc deficient
- Study at Cameroon:- 27.27% of malaria patients were Zn deficient. (Gouado I. et.al, 2007)

b/c

- Redistribution of zinc from plasma (Brown RA 1993)
- Impaired food intake
- Endogenous losses of zinc. (IZiNCG 2004).
Dietary diversity score (DDS) of the participants

- The food groups consumed by the participants ranges from 2-7.

Figure 3: Dietary diversity scores among high school adolescents in Gambella town 2015
Result and Discussion

DDS…

– About 19.4% of adolescents with lowest DDS Zn deficient

– Study at Gaza Strip: serum zinc level is closely related to dietary habits of the adolescents. (AbuNada OS. et. al 2010)

B/c

– Greater DD, better nutritional outcomes & improved micronutrient intake (Chen S, 2012).

– As the number of consumed food increase the chance of including animal source food in the diet may be high
Results and Discussion...

Physical activity levels of the study subjects

Figure 4: - Physical activity levels of high school adolescents in Gambella town 2015
Physical activity...

- In physically **active** and **highly active** adolescents zinc deficiency were **5.98 & 9.39 times** higher respectively.
  - Intense physical exercise may further **exacerbate** suboptimal zinc nutriture

- **Higher zinc losses in urine and sweat.** *(Lukaski HC, 2000).*
  - Role of Zn in formation of **enzyme** for physical activity. *(Lukaski HC, 2005)*
Results and Discussion...

Anthropometric measurements of the participants

- About 7.9% & 11.3% of the adolescents were **stunted** & **wasted** respectively.

![Anthropometric measurements of high school adolescents in Gambella town 2015](image)

Figure 5:- Anthropometric measurements of high school adolescents in Gambella town 2015
Result and Discussion...

Anthropometric...

- About **25%** of the **stunted** adolescents were Zn deficient.
- **Stunting** and **MNDs** were of serious public health significance in the adolescents. *(Mulugeta BA.et.al 2008)*
- Zn-deficiency was **35.8%** in **stunted** school children *(Fesharakinia A, et.al 2009)*

**Reason**

- **Zinc deficiency**, **obesity** and **stunting** can be observed together
- Zn deficiency may enhance **fat deposition** & **decrease lean body mass**. *(Weisstaub G. et.al, 2007)*.

**• Adequate absorbable Zn is essential for health & growth.** *(Brown K H. et.al 2009)*
Result and Discussion...

Wealth status

- The risk of zinc deficient was high among participants with poor & middle wealth status.
- Study at India:- high zinc deficiency amongst adolescent belonging to high, middle and low economic groups (Kapil U et.al. 2011).
- in poor and middle wealth status:-
  • Diets may composed primarily cereals & legumes
  • Few animal-source foods (Brown K H. et.al 2009).
  • Diarrheal disease is a common infection (Brown KH. et.al 2004).
Conclusion and Recommendation

– This study showed that prevalence of zinc deficiency among high school adolescents was low.

– Dietary diversity score, History of Malaria infection, wealth status, stunting and physical activity level were significant variables affecting serum zinc level.
Conclusion and Recommendation

For hospital and regional health bureau

– It is better to give especial attention towards nutrition care for adolescents during malaria attack.
– Improving dietary diversity is crucial for farther improvement in zinc sufficiency.
– Nutrition education center need to be established to provide nutrition education.

For the researchers

– Farther research need to be done on this area.
Conclusion and Recommendation

For the high schools

• Inviting nutritionist/health professional to increase awareness of the adolescents about zinc.

• It is better to establishment nutrition club in the school.

• Advice and education need be given for the highly active adolescents and during physical exercise to increase intake of animal source diets
Acknowledgement

• I would like to express my heartfelt gratitude to the following bodies next to God:-
  – My advisers:- Dr. Solomon Mekonnen (PhD) & Mr. Molla Mesele (BSc, MSc)
  – UoG
  – Ethiopia public health Institute
  – Data collectors
  – Study participants