Nutritional Status of School Children in Babile Town, Eastern Ethiopia

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Abstract

Background: Malnutrition is a major public health concern, for it affects the health, growth, development, and academic performance of school children. However, there is hardly any clear and updated information on the problem in Babile town; therefore, this study was designed to assess the nutritional status of the schoolchildren in Babile Town, Eastern Ethiopia.

Method: A cross-sectional study was done in two public elementary schools in Babile town from May 14 to June 8, 2012. The study included 632 primary schoolchildren who were selected by a systematic sampling technique. Data were collected through a standardized and pretested interview questionnaire. The study subjects' height and weight was measured via anthropometric measurements, their nutritional status through anthropometric indicators of body mass index for age (BMI for age) and height-for-age, and their stool samples via parasitological procedures. The data were analyzed by AnthroPlus software and SPSS Version 16, and binary logistic regression analyses were used to identify the factors associated with malnutrition.

Result: Six hundred thirty two school children aged 5-18 years (with mean age of 10.33 ±2.73 years) were assessed, and of these 56.8% were male. It was found out that the prevalence of stunting was 11.2% and that thinness was 15.7%, whereas that of over nutrition was 11.6% (overweight accounted 8.4% and obesity 3.2%). It was also found out that 14.4% of the subjects were positive for intestinal helminthes. *Hymenolepis nana* was the commonest intestinal helminth (13.3%), and there was no statistically significant association between malnutrition (stunting, thinness and overnutrition) and the intestinal helminths infection, as well as age, sex, religion, ethnicity, maternal education and family size.

Conclusion: Undernutrition was increasing and over nutrition was emerging as nutritional problem among the school children in the study area. To develop a beneficial strategy to alleviate the problem, further studies that identify the factors for the coexistence of both forms of malnutrition are needed.

Key words: *Malnutrition, Nutritional status, School children, Anthropometry, Babile, Ethiopia*

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Introduction

Malnutrition is a condition that results from eating a diet which has either inadequate nutrient (undernutrition) or too much nutrient (overnutrition) to the extent that causes health problems. The word *malnutrition* is commonly used as an alternative to undernutrition (WHO, 1995) but in this manuscript malnutrition refers to both undernutrition and overnutrition.

Poverty is the main cause of undernutrition (Sachs and McArthur, 2005). The degree and distribution of protein–energy undernutrition and micronutrient deficiencies in a given population depends on many factors: politics and economy, education and sanitation, season and climate, food production, cultural and religious food customs, prevalence of infectious diseases, existence and effectiveness of nutritional programs, and availability and quality of health services (De Waal and Whiteside, 2003; Müller and Krawinkel, 2005).

According to some studies done in rural Ethiopia, the extent of stunting in school age children ranges from 26.5% to 42.7% and of thinness from 21.6% to 58.3% (Mulugeta *et al.*, 2009; Mekonnen *et al.*, 2013). Among the urban dwellers of this group, the range is 5.4% to 29.2 for low height for age and 1.4% to 20.8% for thinness (Tadesse, 2005; Reji *et al.*, 2011; Amare *et al.*, 2012; Nguyen *et al.*, 2012; Amare *et al.*, 2013; Herrador *et al.*, 2014).

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Therefore, investigating the nutritional situation of school-age children is important. Because stunting (low height for age) impairs intellectual achievement and school performance (González *et al.*, 2007; Florence *et al.*, 2008), reduces body size and work capacity, and results in obstetric complications (WHO, 1995; González *et al.*, 2007). While thinness (low BMI for age) delays maturation and decreases muscular strength, work capacity, and bone density later in life (González *et al.*, 2007)

Today the world is concerned with not only undernutrition but also overnutrition. Because over nourished children are liable to blood pressure, metabolic syndrome, non-insulin-dependent (type 2) diabetes, and psychological disorders (Marshall *et al.*, 2004; Burke *et al.*, 2008; Nguyen and El-Serag , 2010). A recent study found that one-third of the world's population is now overweight or obese, and 62 percent of these individuals live in developing countries (Marie *et al.*, 2014). The prevalence of overweight and obesity in children in developing countries increased from 8.1% in 1980, to 12.9% in 2013. In Ethiopia, however, undernutrition is more concerning than over nutrition. Very few studies have been done on overnutrition among school children in Ethiopia and it was found out that 8.6% to 12.9% of the children are overweight and 0.8% to 2.7% were obese.

Studies on nutritional status of school-age children would aid in prioritizing and setting up deliberate, evidence- based nutritional intervention programs, targeting the nutritional problem of real concern (Best *et al.*, 2010). But the current nutritional status of school children is not known in Babile town. Therefore, this study has tried to assess the nutritional status of the school children in Babile town, eastern Ethiopia.

Ethical Consideration

Ethical clearance was obtained from the Institutional Research Ethics Review Committee of the College of Health and Medical Sciences, Haramaya University. The objective and benefit of the study was thoroughly explained and informed written consent was obtained from the parents/ guardians of the study participants, and parents/guardians have signed on informed voluntary consent format (which was prepared in three local languages) after the data collector had read for them.

Materials and Methods

Study Design and Setting

A cross sectional study was done on 632 school children in two public elementary schools in Babile town from May 14 to June 8, 2012. The town is located in the eastern part of Ethiopia, about 561 Km away from the capital, Addis Ababa, and it is 1340 meters above sea level. Its population is 17,704. The town has only two elementary schools, and during the survey, 3742 school children (2086 male and 1656 female) were learning in both schools (Report of Babile town, 2011).

Sample Size and Sampling Procedure

Six hundred thirty two schoolchildren from the two schools were selected to participate in the study. A single population proportion formula, $[n = (Z\ \alpha/2)2\ p\ (1-p)] / d^2$, was used to estimate the sample size (Daniel, 1995). The following assumptions were made: the proportion of undernutrition (stunting) among the school children in the area was 5.2 % (p=0.052) (Tadesse, 2005), with 95% confidence interval, and margin of error 4% (d = 0.04). To minimize errors arising from the likelihood of noncompliance, 10% of the sample size was added, and this gave a sample size of 316 for each school.

To select the sample children, the students were first stratified according to their educational level (grade 1 to grade 6). A quota was then allocated for each grade and each class room. Finally, the sample children were selected by systematic random sampling techniques, using class rosters as a sample frame. Children who had taken treatment for intestinal helminths during the month prior to the survey were excluded.

Data Collection

Socio-Demographic Survey

A pre-tested and structured questionnaire which was translated from English into three local languages (Amharic, Oromifa and Somali) was used to collect data on age, sex, religion, ethnicity, family size, and maternal educational status. To assess the suitability of the questionnaire with regard to duration, language appropriateness, and question comprehensibility, it was pre-tested in Bombax elementary school in Gursum woreda, Ethiopia. The questionnaire was administered by two trained BSC nurses.

Anthropometric Measurement

Imprecision is the variability of repeated measurements, and is due to intra and inter-observer measurement differences, while inaccuracy is systematic bias, and may be due to instrument error, or errors of measurement technique (Ulijaszek and Kerr, 1999). To avoid these measurement errors, first intensive training was given for the two data collectors (two BSC nurses) and the supervisors by an experienced nutritionist; second the weight and the height of the study subjects had been measured twice, the data were checked for inconsistencies or implausible values; if found, the child would be measured a third time; third the weighing scale was well-calibrated every morning using known weight.

Body weight was determined to the nearest 0.1 kg on an electronic digital scale (Seca, made in Germany, quality control No.: 5106, max: 150kg, mcd 3811021659), and the children were measured wearing light cloths and in bare foot. The weighing scale was checked every morning with a 10 kg weight and calibrated to the zero before taking every measurement.

The standing height was obtained by measuring the child bare foot, using a centimeter tape fixed on a wood board and posted vertically on the wall. The subjects stood on a flat surface, with their heels, buttocks, scapulae, and head against the wall and their arms hanging freely. Their head was positioned in the Frankfort horizontal plane. A wooden headpiece was lowered until it touched the head of the child and height was recorded to the nearest 0.1 cm (WHO, 1995).

Parasitological Examination

The children were supplied with labeled plastic containers, waterproof papers, and applicator sticks, and they were instructed to bring about 2 gm stool samples and the samples were emulsified in a 10% formalin solution and transported to Haramaya University Collage of Health and Medical Sciences' parasitology laboratory. McMaster method was used for estimating the number of eggs per gram of stool to determine the intensity of infection at an individual level (Levecke *et al.,* 2009) and the examination was carried out by two laboratory technologists. The children who were found positive for intestinal parasites were given appropriate anti-parasite chemotherapy by a medical doctor.

Assessment of Malnutrition

The Z score values of height for age, and BMI for age were calculated by WHO AnthroPlussoft wares (WHO, 2009). And overweight (> + 1SD BMI-for-age z score), obesity (> + 2SD BMI-for-age z score), thinness (< −2SD of BMI-for-age z score), and stunting (< −2SD of height-for-age (HAZ) z score) were defined according to the WHO references (de Onis *et al.*, 2007). Since weight for- height (wasting) is inadequate indicator for monitoring child growth beyond pre-school years due to its inability to distinguish between relative height and body mass, BMI-for-age (thinness) was used to assess acute undernutrition of school-aged children and adolescents according to WHO recommendation (de Onis *et al.*, 2007).

Statistical Analysis

The data were analysed using SPSS (Version 16.0) and the association between the nutritional status outcome variables (stunting, thinness and overnutrition (overweight and obesity) and the predictor variables (age, sex, religion, maternal educational status, family size and intestinal helminth infections) was evaluated through binary logistic regression. During the analysis, sub- categories such as female, 15-18 years of age group, Muslims, literate, households with greater than 5 individuals and those infected with intestinal helminth were used as reference categories from each predictor variables. Confidence intervals (CI) of 95% were reported for each odds ratio (OR). All reported *p*-values were two tailed and statistical significance was set at $P \leq 0.05$.

Results

Socio-Demographic Characteristics of the Children

Six hundred thirty two school children **(**of whom 359 (56.8%) were male) from two primary schools took part in the study. Their age ranged from 5 to 18 years, with a mean of 10.33 years (SD±2.73). Most of them were Muslim (80.4%) and 54.6% of them were from Oromo ethnic group. The average size of their family was 4.41 (SD±2.14), and 56.6% of the respondents' mothers were illiterate. Very few of them (14.4%) had got intestinal helminthes, of which, 13.3% was *Hymenolepis nana* followed by *Enterobius vermicularis, Trichuris trichiura* and Hook worm with prevalence rate of 0.6%, 0.3% and 0.2%, respectively (Table 1).

Table1. Socio-demographic characteristics and intestinal parasite infection of school children in Babile town, eastern Ethiopia, 2012

Variable	Number	Percent
Sex		
Male	359	56.8
Female	273	43.2
Age in years		
5-9	277	43.8
10-14	331	49.2
15-18	44	7
Religion		
Muslim	508	80.4
Orthodox	96	15.2
Protestant	26	4.4
Ethnicity		
Oromo	345	54.6
Somali	164	25.9
Others (Amhara, Gurage, Tigriye)	123	19.5
Maternal Education		
Illiterate	358	56.6
Literate	274	43.4
Family size		
2-5	471	74.5
>5	161	25.5
Intestinal helminths infection		
Infected	91	14.4
Not infected	541	85.6

The mean height, weight and BMI for the male school children were, 137.2cm (SD±14.48), 31.00 kg (SD±9.67) and 16.18 (SD±3.31), respectively; and for the female, 136.9cm (SD ±13.8), 32.27 kg (SD±10.23) and 16.80 (SD±2.89), respectively.

Nutritional Status of the Children

The prevalence of stunting, thinness, and overnutrition was 11.2%, 15.7%, and 11.6%, respectively. Overweight accounted 8.4% but the extent of obesity was 3.2% (Table 2). However, we did not find statistically significant association between the dependent variables (stunting, thinness, and overweight/obesity) and sex (OR=1.46, 95%CI=0.87, 2.44, P=0.151; OR=1.55, 95%CI= 0.99, 2.43, P=0.054; OR=0.91, 95%CI= 0.55, 1.48, P=0.713 respectively). However, the number of stunted and thin male participants was more than that of the female ((12.6% vs. 9.2%) stunted, and (18.1% vs. 12.5%) thin)). (Table3).

Similarly we did not find statistically significant association between the dependent variables (stunting, thinness, and overweight and obesity) and other predictor variables such as age, religion, maternal education, family size, and intestinal helminth infection. However, thinness was more common (20.5%) among the children who were living in a large family (> five members) than among those who were living in smaller families (14%). Of the overweight children, 12.3% were 5 to 9 years of age, and 6.8% of them were 15 to 18 years; and 12.5% of the children were living in small families (2 – 5 members), but 8.7% were living in large families(Table3).

Table 2. Prevalence of stunting, thinness and overweight and obesity by age and sex in school children of Babile, Eastern Ethiopia, 2012

Age (years)	Males (n= 359)						Females (n=273)					
	Stunted		Thin		Over nourished		Stunted		Thin		Over nourished	
	Yes N (%)	No N (%)	Yes N (%)	No N (%)	Yes N (%)	No N (%)	Yes N (%)	No N (%)	Yes N (%)	No N (%)	Yes N (%)	No N (%)
5-9	20 (5.6)	135 (37.6)	34 (9.5)	121 (33.7)	21 (5.8)	134 (37.4)	11 (4)	111 (40.6)	12 (4.4)	110 (40.3)	13 (4.8)	109 (39.9)
10-14	22 (6.1)	152 (42.3)	27 (7.5)	147 (41)	16 (4.5)	158 (44)	12 (4.4)	125 (45.8)	22 (8.1)	115 (42.1)	20 (7.3)	117 (42.9)
15-18	6 (1.1)	24 (7.3)	4 (1.1)	26 (7.2)	3 (0.8)	27 (7.5)	2 (0.8)	12 (4.4)	0 (0)	14 (5.1)	0 (0)	14 (5.1)
Total	46 (12.8)	313 (87.2)	65 (18.1)	294 (81.9)	40 (11.1)	319 (88.9)	25 (9.2)	248 (90.8)	34 (12.5)	239 (87.5)	33 (12.1)	240 (87.9)

Table3. Bivariate logistic regression analysis showing the impact of malnutrition as measured by stunting, thinness and overweight and obesity in school, children of Babile, Eastern Ethiopia, 2012.

Variable	Stunted				Thinness for age				Overweight			
	Yes	NO	COR (95% CI)	p-value	Yes	NO	COR (95% CI)	p-value	Yes	NO	COR (95% CI)	p-value
Sex												
Male	46(12.6)	313(87.2)	1.46(0.87, 2.44)	0.151	65(18.1)	294(81.9)	1.55(0.99, 2.43)	0.054	40(11.1)	319(88.9)	0.91 (0.55, 1.48)	0.713
Female	25(9.2)	248(09.8)	1(Reference)		34(12.5)	239(87.5)	1(Reference)		33(12.1)	240(87.9)	1(Reference)	
Age												
5-9	31(11.2)	246(88.8)	0.79(0.31, 2.04)	0.638	46(16.6)	231(83.4)	1.99 (0.67, 5.83)	0 .46	34(12.3)	243(87.7)	1.91 (0.56, 6.51)	0.584
10-14	34(10.9)	277(89.1)	0.77(0.30, 1.97)	0.596	49(15.8)	262(84.2)	1.87 (0.64, 5.46)		36(11.6)	275(88.4)	1.78 (0.52, 6.07)	
15-18	6(13.6)	38(86.4)	1(Reference)		4(9.1)	40(90.9)	1(Reference)		3(6.8)	41(93.2)	1(Reference)	
Religion												
Christian	19(15.3)	105(84.7)	1.59(0.90, 2.79)	0.110	23(18.5)	101(81.5)	1.29(0.77, 2.16)	0.325	14(11.3)	110(88.7)	0.96(0.52, 1.79)	0.919
Muslim	52(10.2)	456(89.8)	1(Reference)		76(15)	432(85)	1(Reference)		59(11.6)	449(88.4)	1(Reference)	
Ethnicity												
Others	19(15.4)	104(84.6)	1.35(0.75, 2.43)	0.311	21(17)	102(83)	1.10(0.63, 1.92)	0.712	10(8.1)	113(91.9)	0.54(0.26, 1.11)	0.099
Somali	11(6.7)	153(93.3)	0.53(0.26, 1.06)	0.075	24(14.6)	140(85.4)	0.92(0.54, 1.55)	0.766	15(9.1)	149(90.9)	0.62(0.33, 1.14)	0.130
Oromo	41(11.9)	304(88.1)	1(Reference)		54(15.7)	291(84.3)	1(Reference)		48(13.9)	297(86.1)	1(Reference)	
Maternal education												
Illiterate	36(10)	322(90)	0.76(0.46, 1.25)	0.285	54(15.1)	304(84.9)	0.90 (0.58, 1.39)	0.646	45(12.6)	313(87.4)	1.26 (0.76, 2.08)	0.360
Literate	35(12.8)	239(87.2)	1(Reference)		45(16.4)	229(83.6)	1(Reference)		28(10.2)	246(89.8)	1(Reference)	
Family size												
2-5	58(12.3)	413(87.7)	1.59(0.85, 3.00)	0.144	66(14)	405(86)	0.63 (0.39, 1.00)	0.052	59(12.5)	412(87.5)	1.50 (0.81, 2.77)	0.192
>5	13(8.1)	148(91.9)	1(Reference)		33(20.5)	128(79.5)	1(Reference)		14(8.7)	147(91.3)	1(Reference)	
Intestinal helminths												
Not infected	59(10.9)	482(89.1)	0.80(0.41,1.56)	0.524	86(15.9)	455(84.1)	1.13(0.60, 2.13)	0.696	63(11.6)	478(88.4)	1.06(0.52, 2.16)	0.856
Infected	12(13.2)	79(86.8)	1(Reference)		13(14.3)	78(85.7)	1(Reference)		10(11)	81(89)	1(Reference)	

COR, Crude Odds Ratio; CI, Confidence Interval

Discussion

The prevalence of undernutrition (stunting (11.2%) and thinness (15.7%)) that we found in the study area is more than the one found by a similar study in the same area in 2001 (5.2% stunting and 11.6% thinness) (Tadesse, 2005). However, the extent of undernutrition in our study is less than the ones reported from similar studies in Tigray, northern Ethiopia, where stunting was 26.5% and thinness 58.3% (Mulugeta *et al*., 2009); in Fogera District, Northwest Ethiopia, where stunting and thinness were 30.7% and 37.2%, respectively (Mekonnen *et al*., 2013); and from a national survey conducted by Hall, *et al*., in which 22.3% stunning and 23.1%, thinness were found (Hall *et al*., 2008). The differences might be due to the difference in determinants (socio-economic, environmental, inadequate dietary intake and illness) of undernutrition. One explanation for the lower prevalence of undernutrition could be the lower spread and intensity of helminth infection of infection in the present study area.

Many studies have shown that mothers' education level is a key element in improving children's nutritional status (Nabag, 2011; Abuya *et al*., 2012). This is because an educated mother is likely to have better nutritional knowledge, a higher income, and a higher status and power in the household and community, and this, in turn can put her in a better position to make decisions about her children's needs (Mekonnen *et al*., 2005). However, in our study, as shown in Table 3, maternal education showed a non-significant association with nutritional status of the school children (P>0.05). This could be attributed to the fact that most of the literate mothers in this study had lower educational level (read and write). Mothers with lower educational level might not have their own income and power in the household which will put them in a better position to make decisions about her children's needs (Mekonnen *et al*., 2005).

The prevalence of intestinal helminths infection in this study (14.4%) is lower than the ones reported from similar studies done in different parts of Ethiopia (Hall *et al*., 2008; Reji *et al*., 2011; Amare *et al*., 2012; Amare *et al*., 2013; Mekonnen *et al*., 2013], including the present study area (Babile) (27.2%) (Tadesse, 2005). Different reports have shown an association between intestinal parasitism and malnutrition (Hall *et al*., 2008; Amare *et al*., 2012; Mekonnen *et al*., 2013), which was not the case in this study. A possible explanation for this is probably due to the low prevalence and the light intensity of the intestinal parasitic infections. High prevalence and Moderate-to-heavy intensity of intestinal parasitic infections have been reported to be a risk factor for the high stunting and wasting prevalence among school children (Shang *et al*., 2010).

The spread of stunting and thinness did not show a definite trend across age groups (Table3), and similar observation has been reported by other studies in Ethiopia (Reji *et al*., 2011; Amare *et al*., 2012; Nguyen *et al*., 2012; Amare *et al*., 2013; Mekonnen *et al*., 2013). But some studies have found that both stunting and thinness increase with an increase in age (Hall *et al*., 2008; Mulugeta *et al*., 2009; Herrador *et al*., 2014). Moreover, the extent of stunting and thinness did not show a definite trend across sex groups in this study (Table3). A similar observation has been reported by other studies in the country (Reji *et al*., 2011; Amare *et al*., 2012; Nguyen *et al*., 2012; Amare *et al*., 2013; Mekonnen *et al*., 2013; Herrador *et al*., 2014). Some studies have revealed a significantly higher prevalence of both stunting and thinness in male than in female (Hall *et al*., 2008; Nabag, 2011; Fazili *et al*., 2012), while others have reported stunting to be significantly higher among male than female (Mwaniki and Makokha, 2013).

A study done in Khartoum showed that stunting and thinness were associated with family size, the smaller the family size the better the nutritional status of children (Nabag, 2011), and two studies conducted in rural Ethiopia found statistical association among stunting, thinness, and family size (Mekonnen et al., 2013; Herrador *et al*., 2014). But this was not true in our study (P>0.05) (Table 3). This might be due to low magnitude of undernutrition (stunting and thinness) in the present study.

The level of overnutrition in this study was 11.6% (overweight accounted 8.4% and obesity 3.2%). This prevalence is similar to the one reported from Nigeria (11.7%) (Olumakaiye, 2013), but it is less than what have been found in United Arab Emirates (33.6%), Guatemala (32.1%), Egypt (20.5%) FAO, 2006; Groeneveld *et al*., 2007; Junaibi *et al*., 2013), and Hawassa, Ethiopia (15.6%) **(**Teshome *et al*., 2013**),** and greater than the prevalence reported from Addis Ababa (9.4%), Mozambique (6.3%), and Burkina Faso (2.3%)

(Prista *et al.*, 2003; Daboné *et al.*, 2011; Alemu *et al.*, 2014).

Like the similar studies which were done in Hawasa and Addis Ababa, Ethiopia, in our study there was no significant association between overweight and obesity and some socio-demographic predictor variables (sex, age, maternal education and family size) (P>0.05) (Table 3). Unlike ours, the study in Hawassa found a significant association between overweight and obesity and physical activity, socio economic index, frequency of consumption of meat, fruit, and fast food, and time spent on watching TV and using computer (Teshome *et al.*, 2013), and small family size, male headed household, and living in lower and middle income household were positively associated with overweight and/or obesity in the Addis Ababa's study (Alemu *et al.*, 2014).

We feel the following were weaknesses of our study; first our study should have included the income of the family, the dietary knowledge of the mothers, infections other than parasitic infection and the dietary intake of the children. Furthermore, due to the limited resources allocated for the study, only the school children in Babile town were included, and this reduces the generalizability of the finding for the larger population of the woreda with diversified characteristics.

Conclusion and Recommendations

To summarize, this study showed that undernutrition and overnutrition coexisted among school age children. A lower prevalence of undernutrition (stunting and thinness) was observed in the present study area compared to the observations in other studies in Ethiopia; but undernutrition persists and increasing steadily and the magnitude of the problem is not negligible.

The finding of the present study also revealed the emergence of overnutrition, (over weight and obesity) among the school children in Babile town, which had not been reported in the town before. Also, the independent predictor of over nutrition and under nutrition was not identified. So these call for further study with different design and large sample size to determine the factors responsible for malnutrition (both under nutrition and over nutrition) in the study area.

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Competing interests

All the authors declare that they have no conflict of interest associated with the publication of this manuscript.

Authors' contributions

All authors contributed equally in all aspects of this research work and have read and approved the final version of the manuscript

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