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Urban-rural differentials in child undernutrition in Ethiopia

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Empirical evidence on the impacts of household poverty and other socio-demographic factors regarding child undernutrition is essential in targeting resources appropriately to raise the health of the poor and most vulnerable groups. There is a paucity of such evidence in Ethiopia. The present study identified urban-rural differences in the magnitude and determinants of under-five child undernutrition in Ethiopia. Complete anthropometric data for 9,472 under-five children were obtained from the 2011 Ethiopian Demographic and Health Survey dataset. Undernutrition is measured by using underweight as the key outcome variable. The 2006 World Health Organization growth standards are used to calculate underweight. Bivariate and multivariate logistic regression analyses were done to see the strength of association. The magnitude of underweight was observed to be 32.7% [95%CI = (31.7, 33.6)] among rural children and 15.8% [95%CI = (15.1, 16.5)] among urban. Multivariate analyses showed that living in urban of Tigray and Somali regions, poor household wealth status and lack of toilet facility were the urban determinants of child underweight in Ethiopia, whereas living in rural of Gambela and Harari regions, child age of 2 and over, mother's age at first birth being 18 and under, poor and medium household wealth status and child did not take drugs for intestinal parasites in the last six months were factors independently associated with child underweight in the rural of Ethiopia. In conclusion, the study highlighted that special attention needs to be given to policies aimed at reducing underweight based on the magnitude and nature of factors, such as poverty, early marriage, child age, anti-helmentic drugs, toilet facilities and regional characteristics.

Key words: Children, Ethiopia, undernutrition.

INTRODUCTION

Childhood malnutrition is one of the most important public health and development problems in the developing world (Poel et al., 2008; Mohanty and Pathak, 2009). Survivors of child malnutrition can suffer from impaired physical development and limited intellectual abilities which in turn may diminish their working capacity during

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adulthood and have negative effects on national economic growth (Delpeuch et al., 2000; Girma and Genebo, 2002; Alderman et al., 2004). Developing countries can experience gross domestic product (GDP) losses of up to 2 to 6% per annum as a result of undernutrition (International Food Policy Research Institute, 2010).

Ethiopia is the second-most populous country in Africa with 15.4% under-five children (Ethiopian Demographic and Health Survey (EDHS), 2011). These children suffer disproportionately from the poor health and nutrition situation in the country. Malnutrition is the underlying cause of 57.0% of child deaths in Ethiopia (Save the Child UK, 2009) with some of the highest rates of stunting and underweight in the world.

There are only few studies that state the situation of childhood malnutrition in Ethiopia (Alemu et al., 2005; Girma and Genbo, 2002; Mulugeta, 2010). Further, these studies are based on small-scale surveys focusing on particular regions. There is also lack of agreement about the relative importance of factors affecting nutritional status. For example, some studies stress the importance of parental education and nutritional knowledge while others recommend the need to focus on improving the poverty of households (Christiansen and Alderman, 2004; Save the Child UK Ethiopia, 2002). Thus, it is important to better understand the magnitude and determinants of childhood undernutrition and the way in which they differ across different socioeconomic gradients in urban and rural settings. Without such knowledge, it is not possible to develop effective policy strategies to tackle this problem.

MATERIALS AND METHODS

Source of data

This study used secondary data from the 2011 EDHS. Demographic and Health Survey (DHS) is a periodic cross-sectional survey administered at the household level, funded by United States Agency for International Development and United Nations Population Fund to collect population, health and nutrition data in many middle and low income countries (EDHS, 2011). The DHS data used for this study are openly available and can be downloaded from: http://www.measuredhs.com/data/available-datasets.cfm?inputSearch=ETHIOPIA.

Sample size and sampling techniques

The sample size for this study was 9472 under-five children. The samples were selected using a two stage stratified cluster sampling technique in the EDHS (2011). A total of 187 urban and 437 rural clusters were considered, and then all women with 0 to 5 years of age children were selected in each cluster (EDHS, 2011).

Anthropometric measurement

The 2011 EDHS collected data on the nutritional status of children by measuring the height and weight of all children under age five. Data were collected to calculate three indices of anthropometric indicators: weight-for-age (underweight), height-for-age (stunting) and weight-for-height (wasting). The indicators were calculated using the 2006 World Health Organization (WHO) growth standards (WHO, 2006). This paper used underweight, which is a composite index of stunting and wasting, as the key outcome variable. A child can be underweight for his/her age because he/she is stunted, wasted, or both. It is an overall indicator of a population nutritional health.

Statistical analysis

Data were analyzed using SPSS software package version 16.0. Bivariate and multivariate logistic regression analyses were done to see the strength of association between the independent variables and the dependent variable (underweight).

Ethics

Official permission was secured from the Central Statistical Agency to use the DHS dataset for this study.

RESULTS

Socio-demographic characteristics

Out of the 9472 respondents, 7947 (83.9%) were rural dwellers. The majority, 1495 (15.8%) and 1360 (14.4%) of them were from Oromiya and Southern Nations, Nationalities, and Peoples (SNNP) regions, respectively. More than half, 4935 (52.1%) were Christians. About 4961 (52.4%) belonged to the age group of 25 to 34 years. Regarding age at first birth, 4781 (50.5%) of them were 18 and under. Nearly all, 8827 (93.2%), were married. More than half, 5106 (53.9%), reported that they did not work in the last 1 year before survey. The majority, 6611 (69.8%) and 4843 (51.1%), of mothers and their husbands had no formal education, respectively. Males were household heads in 7776 (82.1%) households. More than three-fourths, 7248 (76.5%), of the household heads aged 30 and above. The majority, 5706 (60.2%), of the children aged 3 and under. In 7603 (80.3%) of the households, the number of under-five children were 2 and less than. Nearly half, 4674 (49.3%), were poor (Table 1).

Environmental conditions

More than half, 4825 (50.9%), of respondents reported that they had no toilet facility. The majority, 8210 (86.7%), of them informed that the main floor material of their house was dirt. Regarding source of drinking water, 5228 (55.2%) of the respondents reported that they used water from unimproved source for drinking (Table 1).

Table 1. Socio-demographic characteristics and environmental conditions of study participants in Ethiopia, 2014.

Characteristic	Frequency	Percent (%)
Residence		
Urban	1525	16.1
Rural	7947	83.9
Region		
Tigray	1063	11.2
Affar	889	9.4
Amhara	1028	10.9
Oromiya	1495	15.8
Somali	749	7.9
Benishangul-Gumuz	824	8.7
SNNP	1360	14.4
Gambela	672	7.1
Harari	49	5.2
Dire Dawa	575	6.1
Addis Ababa	321	3.4
Religion of the mother		
Christian	4935	52.1
Muslim	4343	45.9
Other	194	2
Age of mother (in years)		
15-24	2229	23.5
25-34	4961	52.4
35-49	2282	24.1
Mother's age at first birth		
18 & less	4781	50.5
19 & above	4691	49.5
Mother's marital status		
Single	645	6.8
Married	8827	93.2
Mother worked in the last 1 year		
No	5106	53.9
Yes	4366	46.1
Mother's educational level		
No education	6611	69.8
Primary & above	2861	30.2
Husband/partner's educational level		
No education	4843	51.1
Primary & above	4480	47.3

Table 1. Contd.

Sex of household head		
Male	7776	82.1
Female	1696	17.9
Age of household head (in years)		
29 and less	2224	23.5
30-40	4574	48.3
41 and above	2674	28.2
Child age (in years)		
1	2105	22.2
2-3	3601	38
4-5	3766	39.8
No of under-five children in the house		
2 and less	7603	80.3
3 and above	1869	19.7
Wealth status		
Poor	4674	49.3
Medium	1568	16.6
Rich	3230	34.1
Type of toilet facility		
Flush toilet	233	2.5
Pit latrine	4005	42.3
Other facility	409	4.3
No facility	4825	50.9
Main floor material		
Dirt	8210	86.7
Non dirt	1262	13.3
Source of drinking water		
Improved	4244	44.8
Unimproved	5228	55.2

Access to basic health services

Nearly half, 4625 (48.8%), of the children did not receive vitamin A in six months prior to the survey. The majority, 4625 (80.3%), of the mothers reported that their children did not take drugs for intestinal parasites in six months prior to the survey. They also informed that more than three-fourths, 3863 (76.0%) of their children did not complete all vaccinations.

Magnitude

The magnitude of underweight among under-five children was observed to be 30.0% [95%CI = (29.1, 30.9)], with 9.9% severe underweight. It was 32.7% [95%CI = (31.7, 33.6)] for rural and 15.8% [95%CI = (15.1, 16.5)] for urban.

Determinants

Overall model

Table 2 presents the bivariate and multivariate logistic regression outputs. The study identified socioeconomic, demographic and health service related factors as independent predictors of under-five child malnutrition

Table 2. Bivariate and multivariate logistic regression analysis outputs of underweight among under-five children in Ethiopia, 2014.

Variable	Crude OR (95% CI)	Adjusted OR (95%CI)
Region		
Addis Ababa	1	1
Tigray	1.42 (1.14, 1.78)	1.54 (1.06, 2.25)
Affar	1.85 (1.48, 2.32)	1.26 (0.89, 1.79)
Amhara	1.30 (1.04, 1.63)	1.43 (0.99, 2.04)
Oromiya	0.88 (0.71, 1.09)	0.89 (0.65, 1.23)
Somali	1.20 (0.95, 1.52)	1.13 (0.79, 1.62)
Benishangul-Gumuz	1.35 (1.07, 1.70)	1.40 (0.98, 1.98)
SNNP	1.00 (0.81, 1.25)	1.37 (0.96, 1.95)
Gambela	0.70 (0.54, 0.90)	0.78 (0.52, 1.16)
Harari	0.64 (0.48, 0.85)	0.64 (0.43, 0.96)
Dire Dawa	0.18 (0.11, 0.29)	0.44 (0.15, 1.31)
Child age (in years)		
1	1	1
2-3	2.50 (2.20, 2.85)	2.14 (1.71, 2.69)
4-5	2.33 (2.04, 2.66)	1.96 (1.56, 2.45)
Mother's age at first birth		
19 and above	1	1
18 and less	1.14 (1.04, 1.24)	1.15 (1.01, 1.31)
Maternal education		
Primary and above	1	1
No education	1.84 (1.66, 2.03)	1.11 (0.95, 1.30)
Husband/partner's education		
Primary and above	1	1
No education	1.62 (1.48, 1.77)	1.01 (0.88, 1.16)
Wealth status		
Rich	1	1
Poor	2.21 (1.99, 2.45)	1.56 (1.29, 1.88)
Medium	1.75 (1.53, 2.01)	1.31 (1.06, 1.62)
Type of toilet facility		
Flush toilet	1	1
Pit latrine	1.79 (1.25, 2.56)	1.29 (0.77, 2.16)
No facility	2.85 (1.99, 4.06)	1.56 (0.92, 2.63)
Other facility	1.81 (1.19, 2.74)	1.09 (0.60, 1.97)
Source of drinking water		
Improved	1	1
Unimproved	1.36 (1.24, 1.49)	0.95 (0.82, 1.09)
Drugs for intestinal parasites		
Yes	1	1
No	0.97 (0.87, 1.09)	1.20 (1.03, 1.41)

measured in terms of underweight on the multivariate analysis. These include living in Tigray [AOR: 1.54, 95%CI: (1.06, 2.25)] and Harari [AOR: 0.64, 95%CI: (0.43, 0.96)] regions, child age of 2 to 3 years [AOR: 2.14, 95%CI: (1.71, 2.69)] and 4 to 5 years [AOR: 1.96, 95%CI: (1.56, 2.45)], mother's age at first birth being 18 and under [AOR: 1.15, 95%CI: (1.01, 1.31)], poor [AOR: 1.56, 95%CI: (1.29, 1.88)] and medium [AOR: 1.31, 95%CI: (1.06, 1.62)] household wealth status, and child did not take drugs for intestinal parasites in the last six months [AOR: 1.20, 95%CI: (1.03, 1.41)] (Table 2).

Urban versus rural model

Factors significantly associated with underweight among under-five children in urban households were living in urban of Tigray [AOR: 4.95, 95%CI: (1.35, 18.09)] and Somali [AOR: 3.60, 95%CI: (1.35, 9.59)] regions, poor [AOR: 4.41, 95%CI: (1.13, 17.17)] household wealth status, and household had no toilet facility [AOR: 3.41, 95%CI: (1.01, 11.55)]. Whereas, living in rural of Gambela [AOR: 0.58, 95%CI: (0.37, 0.90)] and Harari [AOR: 0.59, 95%CI: (0.38, 0.92)] regions, child age of 2 to 3 years [AOR: 2.15, 95%CI: (1.70, 2.73)] and 4 to 5 years [AOR: 2.00, 95%CI: (1.58, 2.53)], mother's age at first birth being 18 and under [AOR: 1.15, 95%CI: (1.01, 1.32)], poor [AOR: 1.57, 95%CI: (1.28, 1.91)] and medium [AOR: 1.26, 95%CI: (1.02, 1.57)] household wealth status, and child did not take drugs for intestinal parasites in the last six months [AOR: 1.24, 95%CI: (1.05, 1.47)] were factors independently associated with underweight among under-five children in the rural of Ethiopia (Table 3).

DISCUSSION

Policy makers at global, national and local levels are more than ever concerned about the rising trend in child malnutrition in Subsaharan Africa and how it can be curtailed in the context of general food and basic-needs policies. A number of studies have examined the determinants of child nutritional status in Subsaharan Africa (Gewa, 2009; Zivin et al., 2009; Alderman, 2007). There have also been attempts to examine the nature, extent and determinants of child nutritional status in East Africa. Examples of recent empirical studies include Kabubo-Mariara et al. (2009), Lawson and Appleton (2007), Alderman (2007) and Ssewanyana (2003). To support program setting at the local and national levels, this study was conducted to identify urban-rural differences in the magnitude and determinants of under five child undernutrition in Ethiopia by using the 2011 EDHS data.

In previous surveys (Melkie, 2007; Kenya DHS, 2010; Nigeria DHS, 2013; Tanzania DHS, 2010), the magnitude of underweight among children from rural settings was found to be high as compared to those from urban settings in this study. This implies that children from rural settings are the most vulnerable members of society and the existence of intergenerational effect of childhood undernutrition. To allow children development to be affected by poor nutrition is to perpetuate the vicious cycle of poverty and undernutrition, and to waste human potential. In the case, the government will not be able to accelerate economic development over long term until the children are assured of optimal growth and development. There is, therefore, a moral imperative for the government to reduce the burden borne by children, particularly in rural settings.

Childhood undernutrition remains to be a major public health problem in Ethiopia. This study found the evidence that socioeconomic, demographic and health service related factors have a significant influence on the odds of underweight in under-five children in urban and rural settings. Findings of this study have shown regional variations in the risk of underweight. The odds of underweight among children living in Tigray were 4.95 times higher than those living in Addis Ababa. In contrast, children living in Harari were 0.64 times less likely to become underweight. Tigray and Somali regions were remained significant in the urban multivariate model, while Gambela and Harari regions in the rural multivariate model. The observed difference may reflect ecological constraints, worse general living conditions, harmful socio-cultural practices, unequal intra-household food distribution, seasonal food insecurity, poor access to public facilities and other related factors. This is true according to several other studies (Mulugeta et al., 2010; Girma and Genbo, 2002). The persistence of this regional inequality can point to an intergenerational effect of undernutrition. Since women who were undernourished during childhood are more likely to give birth to low-birth-weight children transmitting past prevalence of child undernutrition to have an effect on current prevalence (Girma and Genbo, 2002), further research on socio-cultural practices, intra-household food distribution, geospatial clustering and other related factors is suggested.

Economic status of a household is an indicator of access to adequate food supplies, use of health services, availability of improved water sources and sanitation facilities which are prime determinants of child nutritional status (The United Nations Children's Fund (UNICEF), 1990). Comparative studies on child nutrition for more than 15 countries (Sommerfelt and Kathryn, 1994) and some local studies in Ethiopia (Genebo et al., 1999; Yimer, 2000) have also shown the importance of household economic status to improve childhood malnutrition.

Table 3. Multivariate logistic regression analysis outputs of underweight among under-five children in urban and rural of Ethiopia, 2014.

Variable	Adjusted OR (95%CI)	
	Urban	Rural
Region		
Addis Ababa	1	-
Dire Dawa	1.11 (0.29, 4.27)	1
Tigray	4.95 (1.35, 18.09)	1.22 (0.81, 1.84)
Affar	2.41 (0.82, 7.06)	1.09 (0.74, 1.59)
Amhara	2.17 (0.57, 8.21)	1.19 (0.81, 1.74)
Oromiya	1.12 (0.34, 3.64)	0.77 (0.54, 1.08)
Somali	3.60 (1.35, 9.59)	0.84 (0.56, 1.25)
Benishangul-Gumuz	1.35 (0.36, 5.11)	1.21 (0.83, 1.75)
SNNP	2.63 (0.72, 9.67)	1.12 (0.76, 1.64)
Gambela	2.11 (0.63, 7.09)	0.58 (0.37, 0.90)
Harari	0.76 (0.21, 2.73)	0.59 (0.38, 0.92)
Child age (in years)		
1	1	1
2-3	2.22 (0.97, 5.10)	2.15 (1.70, 2.73)
4-5	1.57 (0.69, 3.59)	2.00 (1.58, 2.53)
Mother's age at first birth		
18 and less	1.18 (0.74, 1.87)	1.15 (1.01, 1.32)
19 and above	1	1
Maternal education		
Primary and above	1	1
No education	1.37 (0.77, 2.41)	1.10 (0.93, 1.29)
Husband/partner's education		
Primary and above	1	1
No education	1.11 (0.62, 2.00)	1.00 (0.87, 1.16)
Wealth status		
Rich	1	1
Poor	4.41 (1.13, 17.17)	1.57 (1.28, 1.91)
Medium	1.38 (0.61, 3.10)	1.26 (1.02, 1.57)
Type of toilet facility		
Flush toilet	1	1
Pit latrine	2.43 (0.76, 7.83)	1.04 (0.57, 1.90)
No facility	3.41 (1.01, 11.55)	1.22 (0.66, 2.24)
Other facility	2.62 (0.56, 12.31)	0.84 (0.43, 1.66)
Source of drinking water		
Improved	1	1
Unimproved	1.02(0.45, 2.31)	0.95 (0.82, 1.20)
Drugs for intestinal parasites		
Yes	1	1
No	0.85(0.48, 1.52)	1.24 (1.05, 1.47)

The findings of this study showed that compared with children residing in richer households, the risk of being underweight for children in poor and medium households were significant. The same holds true for children from rural households. However, medium wealth status households disappear from the multivariate urban model. Therefore measures should include government action to support the poor, and to bring about rapid economic growth at the national level. To this effect, it is important to develop community-based interventions giving priority to poor households as a short-term solution. Urgent implementation of poverty reduction strategies and programs designed by the government could also serve as a long-term solution to the problem.

The findings of this study also showed that the risk of underweight increases with age of children. The same is true in the rural multivariate model. This is consistent with other local and regional studies in Ethiopia which showed that an increase in malnutrition with increase in age and number of the children in the household (Yimer, 2000; Genebo et al., 1999; Samson and Lakech, 2000). This may be an indication of inappropriate food supplementation in quantity and quality, and exposure to childhood diseases. This calls an urgent need for community-based nutrition intervention programs to curve the problem, especially in the rural of Ethiopia.

Mother's age at first birth being 18 and under was significantly associated with underweight among the children. This also remains true in the rural multivariate model. This could be explained by poor socio-economic conditions affecting mother's wellbeing as a result of early marriage. Therefore programs on delaying marriage, and support women socially and economically are critical to improve nutritional status of their children. Though the bivariate analysis showed a positive association between child nutritional status and the availability of safe drinking water and toilet facility, the significance of these variables disappears in the multivariate model. This is also true according to other studies (Ukuwuani and Suchindran, 2003). The justification for this could be that since water and sanitation are not only environmental measures but may also be proxies for economic status, the multivariate model economic status was a more direct measure that may override these less precise measures. However, lack of toilet facility remains strong independent predictor of underweight in the urban multivariate model. Cognizant of this fact, programs designed to promote nutritional status of children in Ethiopia should target on providing improved toilet facilities for urban households.

Contrary to what was found in many other developing countries (Loaiza, 1997; Tharakan and Suchindran, 1999), findings of this study showed that there was no significant difference in the risk of underweight in children by their parents' educational level. This indicates the overriding influence of poverty on nutritional status of children and the low level of education of parents. It should be noted that around 70.0% of mothers and more than half of husbands reported having no education. It is therefore imperative that young girls and boys be enrolled in compulsory primary school education and opportunities should also be given to adult women and men to take part in non-formal education. Health and nutrition education should also be an integral part of the education process.

In Ethiopia, intestinal parasitic infections are of serious public health concern (Mengistu et al., 2007). According to a report by the Ministry of Health, helminthiasis is the third leading cause of outpatient visits in health institutions in 2005 to 2006 (Ministry of Health, 2006). Parasitic infections are thought to contribute to child malnutrition through subtle reduction in digestion and absorption, reduced appetite, chronic inflammation and loss of nutrients (Stansfield et al., 2002; Stephenson et al., 2000). In this study, non-treatment against enteric parasitic infections has shown to be significantly associated with underweight among under-five children. The same holds true in the rural multivariate model. A study conducted in Kenyan revealed that children who were infected with intestinal parasites and then treated with albendazole orpyrantel pamoate, all showed significant improvement in appetite and physical performance just 3 weeks to 4 months after treatment compared to the control group (Stephenson et al., 1993). In Brazil, it was found that helminthic infection during the first 2 years of life is associated with impaired growth, and that a single treatment of albendazole may benefit the child nutritionally in the long run (Stephenson et al., 2000). This signifies that provision of anti-helmentic drugs for under-five children, especially in rural households, could improve their nutritional status.

The findings of this study must be interpreted in the light of its limitations. We have not had access to the full range of the socio-demographic and other variables in the EDHS dataset. Another limitation is that we extracted and analyzed the data from retrospective records of child record file from the 2011 EDHS dataset which might affect the validity of the results. Dietary aspect which is the immediate determinant of nutritional status is not included in this study.

Conclusion

The study highlighted that special attention needs to be given to policies aimed at reducing underweight based on the magnitude and nature of factors, such as poverty, early marriage, child age, anti-helmentic drugs, toilet facilities and regional characteristics.

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Conflict of Interest

The authors declare that they have no competing interest.

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