

Overweight and Obesity among children under five in Ethiopia: Analysis from 2016 National Demographic Health Survey: A Case Control Study

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Abstract

Background Researches on nutrition in Sub-Saharan Africa have primarily focused on under-nutrition. Despite, the sufficient evidence of an ongoing nutritional transition to over nutrition in these settings, the determinant factors is unclear. Therefore, this study is aimed to assess the determinants of overweight and obesity among children under five years in Ethiopia. Methods A case control study design was employed to the data collected by the 2016 Ethiopian Demographic and Health Survey which used a stratified, two-stage cluster sampling design. Six hundred seventy two children of aged under five were extracted through Body Mass Index (BMI). Based on WHO 2006 reference population Z-score was chosen for age; 224 children enrolled (BMI z-score >2) as cases and 448 children (BMI z-score between -2 and +2) as control group from the national survey data set. Regression analyses were performed to investigate determinant factors of children with overweight and obesity. Results Urban residence (AOR = 2.63, 95% CI: 1.29, 5.34), Boys (AOR = 1.56, 95% CI: 1.10, 2.22) and age of the child less than 6 months (AOR=3.40, 95%CI: 2.05, 5.64) were the determinants for being childhood overweight and obesity. Conclusion Being in the age of less than 24 months, urban residence and boys leads to childhood overweight or obesity. Therefore, this study suggests that nutrition education on feeding practices in the urban setting, targeted; age-specific infant and young child feeding practices are needed to improve nutrition among children in Ethiopia.

Background

Overweight and obesity are defined as abnormal or excessive accumulation of fat which may impair health [1]. A combination of childhood overweight and obesity are of the most serious public health challenges of the 21st century [2]. In 2014, globally, an estimated 41 million children under 5 years of age were affected by overweight or obesity: 48% living in Asia and 25% in Africa [3]. The prevalence of childhood overweight and obesity is increasing in all countries, with the most rapid rise in low and middle-income countries with majority of overweight and obese children live in developing countries, where the rate of increase has been more than 30% higher than that of developed countries [4, 5].

In Africa, the number of overweight and obese children has nearly doubled from 5.4 million in 1990 to 10.3 million in 2014 [6]. The prevalence of infant, childhood and adolescent overweight and obesity may be plateauing in African settings, but in absolute numbers there are more overweight and obese children living in low and middle-income countries than in high-income countries [5, 7].

Moreover, children with overweight and obesity suffer severe health consequences in childhood and are at high risk of becoming obese adults, resulting increased risk of non-communicable diseases and reproductive disorders later in their life [1,4]. The dramatic increase in the overweight and obese population in sub-Saharan Africa countries has considerable implications for society in the future. The implications is crucial in terms of health care needs, greater burden, and increasing inequalities in health due to the trends in obesity associated with lower socioeconomic status. Many factors can be associated with overweight and obesity in children. Economic growth or socioeconomic status, maternal level of

education, marital status, smoking during pregnancy, sex of the child, birth weight and the child's birth rank, area of residence, place of residence, age of the child, BMI of parents have been found as risk factors of childhood overweight and obesity [5, 8-10].

In Ethiopia, a low-income country which is still scarred by childhood malnutrition, childhood obesity is not yet perceived as an emerging health issue and receives little attention. According to UNICEF 2017 annual report there is overall increment of prevalence of overweight among children from 1.7 to 3.6% in Ethiopia [11]. Therefore, within this evidence, there are incongruent results in the determinant factors of overweight and obesity among literatures in Ethiopia. This study aimed to identify the determinants of overweight and obesity among children in Ethiopia, using a representative sample of children aged less than five years from the demographic health survey 2016. Thus, this finding highlighted in designing effective preventive strategies to clench the rising burden of early childhood overweight and obesity and its consequential morbidity and mortality in adulthood.

Methods

Data Source and Study Design:

This case control study design was analyzed based on 2016 Ethiopia Demographic and Health Survey (EDHS), which was designed as a nationally representative survey. It is the fourth Demographic and Health Survey (DHS) conducted in Ethiopia by the Central Statistical Agency (CSA) through the request of Federal Ministry of Health (FMoH) in collaboration with United States Agency for International Development (USAID) and ICF international as part of the International Demographic and Health Survey program known as MEASURE evaluation.

Sampling techniques and population

The 2016 EDHS sampling employed two-stage stratified cluster sampling technique to provide estimates for the health and demographic variables of interest for the country, structured into nine regional states and two City Administrations Councils (Addis Ababa and Dire Dawa).

The sampling frame was provided from the 2007 Ethiopian Population and Housing Census (PHC) conducted by the CSA. The census frame consisted of a total of 84,915 Enumeration Areas (EAs). The sample included 645 enumeration areas, (202 urban and 443 rural). An EA is a geographic area covering an average of 181 households. A nationally representative sample of 18,008 households and 10,752 children under age five years were eligible for height and weight measurements [12].

The 'child record' data set was downloaded from the MEASURE DHS website. All the surveys included boys and girls, and age ranged from 0 to 59 months. Child and maternal anthropometric data and various socio demographic variables were extracted from the data sets. The extracted and retrieved socio-demographic variables were: maternal age, educational status, place of residence, household wealth index (a composite measure of a household's cumulative living standard), child's age, sex, birth order,

frequency of reading magazine, listening radio, watching television, maternal BMI and total children ever born.

After BMI Z-score of children was categorized in to normal weight (above minus two standard deviations (-2 SD) and below plus two standard deviations (+2 SD) from the median of the reference population), underweight (below minus two standard deviations (-2 SD) from the median of the reference population) and overweight and obese (more than two standard deviations (+2 SD) above the median of the reference population).

We retrieved children with underweight and those whose BMI z-score were missing or was recorded as “Height out of plausible limits” or “Age in days out of plausible limits” or “Flagged cases”, as their values were unusable since they were recorded in the database under special codes which corresponded either to responses that were considered inconsistent with other response in the questionnaire and thought to be probably an error, or to responses which value was “Don’t know”.

Finally, all eligible overweight and obese children (n=224) were included in to the analysis as cases and 448 normal weight children as controls were selected through systematic random sampling techniques from 7168 normal weight children living with their mothers. **Outcome variable:** According to WHO recommendations children who had BMI z-score over 2 were classified as overweight and obese children characterized as cases. And those who had BMI z-score ranged from -2 to 2 were classified as normal weight children, which are considered as controls [13].

Data analysis

Data analyses were carried out using SPSS 21TM – software. Cross tabulation was used to describe frequency or percentage of study participants. Bivariate regression analysis (with odds ratio and 95 percent confidence interval) was done to see the association of individual variables with the outcome of interest. Variables with $p < 0.25$ at bivariate analysis were entered to multivariable logistic regression analysis using the forward likelihood ratio method. Finally, $P < 0.01$ in multivariable analysis were considered to declare association between independent predictors and overweight and obese children.

Results

Socio-demographic characteristics of under five children

We enrolled 224 cases and 448 controls of children aged 0-59 months old. Mean age of cases was 23.6 (SD±16.3) months and mean age of controls were 32.3 (SD±16.6). Two third 150 (67.0%) of the cases and majority 382 (85.3%) of the controls were from rural areas. Nearly one fifth 46(20.5%) of the cases and 71 (15.8%) controls had reside in Oromia region.

Regarding sex of the child, about 129 (57.6%) of cases made up boys and above half 233 (52.0%) of controls made up girls. Sixty two percent (n=141) of cases belonged to the low birth rank (1-3 birth) and

almost half 230 (51.3%) of controls belonged to high birth rank category (>3 births). Concerning children age, four out of ten 100 (44.6%) of the cases and nearly two third 297 (66.3%) of controls were aged 24 to 59 months [Table 1].

Maternal and Household Characteristics

This study revealed that, almost half 120 (53.6%) mothers of the cases and six out of ten 286 (63.8%) mothers of the controls didn't attend formal education. Regarding to maternal communication ability, majority 195 (87.1%) mothers of the cases and nine of ten mothers 420 (93.8%) of controls were not reading newspapers or magazines at all. Above two third 155 (69.2%) mothers of the cases and more than three fourth 351 (78.3) mothers of the controls did not listen to the radio at all. In addition 158 (70.5%) mothers of the cases and 372 (83.0%) mothers of the controls did not watch television at all.

Concerning maternal body mass index, six out of ten 146(65.2%) mothers of cases and above two third 311(69.4%) mothers of controls had belong to normal weight.

In relation to the wealth index status, only one third 74 (33.0%) of the cases belonged to richest category and 162 (36.2%) of the controls were poorest. Above two third 155 (69.2%) of the households of the cases and half 243 (54.2%) of the households of controls had four and above children [Table 2].

Determinants Associated with Overweight and Obese Children

In this study, residence, sex and age of the child were significantly associated with the condition of being overweight and obese children (Table 3). The odds of residing in urban were 2.6 times higher among overweight or obese than the normal weight children (AOR = 2.63, 95% CI: 1.29, 5.34).

The odds of being overweight or obese children among boys were 1.5 times higher when compared with controls (AOR = 1.56, 95% CI: 1.10, 2.22). Children in the age of less than 6 months had three times higher odds of becoming overweight and obese (AOR=3.40, 95%CI: 2.05, 5.64) and children in the age 6-24 months had two times higher odds of becoming overweight or obese children compared to controls (AOR=2.40, 95% CI: 1.61, 3.58).

Discussion

This study sought to determine the determinants of childhood overweight and obesity in Ethiopia using DHS 2016 data. Our findings showed that sex, age of the child, and place of residence were the determinants of overweight and obesity among children in Ethiopia.

In this study, child age was found to be a strong determinant of overweight and obese. This is corroborated with studies done in Ethiopia at Hawassa [14], Gondar [15], and Cameroon [16], SSA [9] and Malasia [17]. This might be as age of the child increases getting a chance to join kindergarten which may attribute to increase physical activity. This finding suggests that age specific nutritional counseling strategies during childhood are necessary.

Children who were living in urban areas were more affected by overweight and obesity. This is in line with the study done in Hawaii [18], Peru [19] and Poland [20, 21]. Evidence argue that place of residence is not an independent variable but rather a proxy measure for socio economic status based on the economic or ethnic/racial homogeneity within a specific area [18]. Furthermore, this might be partly explained by differences in lifestyles, level of urbanization, access to food supply and increasing presence of fast food chains or increasing intake of energy-dense processed foods. The rapid nutritional transition that exists in urban areas might also be considered as additional evidence. This implies it is vital for the health system managers to take the lead in prevention and early identification of overweight children and introducing a primary prevention approach to overweight and obesity.

The relation between sex of child and overweight or obesity shows that, boys being more at risk of overweight than girls in less than five years of age group. The finding of this study is consistent with studies done in Ghana [22], Cameroon [16], China [23] and Brazil [24]. But in contrast with studies [25-27] girls' predominance and no sex difference noticed among boys and girls across literature [28]. This might be due to supporting the hypothesis that overweight or obesity is a result of interactions between genetic, environmental factors, metabolism, eating and physical activity behavior, and social and individual psychology [29].

Our source of data, the DHS had some shortcomings. First, using this secondary data limited us from including most important variables in our analysis like nutritional characteristics that is child's diet or feeding habits would have not permitted us to assess their contribution to the development of overweight and get better adjusted estimates. The second potential major limitation is the frequency of missing data specifically birth weight of babies.

Conclusions

The finding of this study revealed that age of the child, urban place of residence and boy sex were the determinants of childhood overweight and obesity in Ethiopia.

Therefore, this study suggests that nutrition education on feeding practices and physical activities should be boosted in the urban setting and targeted, age-specific infant and young child feeding practices are needed to improve nutrition. Moreover, further study is recommended to explore other potential risk factors with childhood overweight and obesity.

Abbreviations

BMI: Body mass index

CI: Confidence interval

EDHS: Ethiopia Demographic Health Survey

Declarations

Ethics approval and consent to participate

The primary researchers of the 2016 Ethiopia Demographic Health Survey obtained ethical clearance, and there was no need of ethical clearance for this secondary analysis. However, permission was obtained from measure DHS project website to access the dataset.

Consent for publication

'Not applicable'

Availability of data and material

The data that support the findings of this study are available from MEASURE DHS project but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the MEASURE DHS project upon reasonable online request after submission of concept paper".

Competing interest

The author(s) declare that they have no competing interests.

Funding

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Authors' contribution

HGW: Conceived the idea, designed, performed statistical analysis and write the manuscript. TGG & AM: Critically reviewed the manuscript and provided feedback. MWA: Reviewed the manuscript and provided useful comments during the analysis and interpretation. All of the authors read and approved the manuscript.

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Tables

Table-1: Child Characteristics among Overweight & Obese Under Five, Ethiopia, 2016

Characteristics	Cases(N=224), n (%)	Controls(N=448), n (%)	Total (N=672), n(%)
Place of Residence			
Urban	74(33.0)	66(14.7)	140(20.8)
Rural	150(67.0)	382(85.3)	532(79.2)
Region			
Tigray	16(7.1)	42(9.4)	58(8.6)
Afar	11(4.9)	42(9.4)	53(7.9)
Amhara	15(6.7)	47(10.5)	62(9.2)
Oromia	46(20.5)	71(15.8)	117(17.5)
Ethio-Somalia	18(8.0)	54(12.5)	74(11.0)
Benshangul Gumz	14(6.2)	35(7.8)	49(7.3)
SNNPR	43(19.2)	68(15.2)	111(16.5)
Gambela	8(3.6)	31(6.9)	39(5.8)
Hareri	12(5.4)	15(3.3)	27(4.0)
Addis Ababa	32(14.3)	16(3.6)	48(7.1)
DireDawa	9(4.1)	25(5.6)	34(5.1)
Sex of Child			
Boys	129(57.6)	215(48.0)	344(51.2)
Girls	95(42.4)	233(52.0)	328(48.8)
Birth Rank			
Low birth rank (1-3)	141(62.9)	218(48.7)	359(53.4)
High birth rank (> 3)	83(37.1)	230(51.3)	313(46.6)
Age of Child			
Less than 6 months	46(20.5)	43(9.6)	89(13.2)
6-24 months	78(34.8)	108(24.1)	186(27.7)
24-59 months	100(44.6)	297(66.3)	397(59.1)

Table - 2: Maternal and Household Characteristics among Overweight & Obese Under Five Children, Ethiopia, EDHS 2016

Characteristics	Cases(N=224), n (%)	Controls(N=448), n (%)	Total (N=672), n (%)
Mother's Highest Educational Level			
No education	120(53.6)	286(63.8)	406(60.4)
Primary	64(28.6)	125(27.9)	189(28.1)
Secondary	25(11.2)	22(4.9)	47(7.0)
Higher	15(6.7)	15(3.3)	30(4.5)
Frequency of Reading Newspapers/Magazines			
Not at all	195(87.1)	420(93.8)	615(91.5)
Less than a week	17(7.6)	25(5.6)	42(6.2)
At least a week	12(5.4)	3(0.7)	15(2.2)
Frequency of Listening Radio			
Not at all	155(69.2)	351(78.3)	506(75.3)
Less than a week	30(13.4)	40(8.9)	70(10.4)
At least a week	39(17.4)	57(12.7)	96(14.3)
Frequency of Watching TV			
Not at all	158(70.5)	372(83.0)	530(78.9)
Less than a week	12(5.4)	31(6.9)	43(6.4)
At least a week	54(24.1)	45(10.0)	99(14.7)
BMI of Mother			
Under weight	33(14.7)	84(18.8)	117(17.4)
Normal weight	146(65.2)	311(69.4)	457(68.0)
Overweight and obese	45(20.1)	53(11.8)	98(14.6)
Wealth Index			
Poorest	61(27.2)	162(36.2)	223(33.2)
Poorer	27(12.1)	78(17.4)	105(15.6)
Middle	28(12.5)	68(15.2)	96(14.3)
Richer	34(15.2)	56(12.5)	90(13.4)
Richest	74(33.0)	84(18.8)	158(23.5)
Children Ever Born			
Four and above	155(69.2)	243(54.2)	398(59.2)
Less than four	69(30.8)	205(45.8)	274(40.8)

Table 3: Association between Risk Factors and Overweight and Obese Children under Five years, Ethiopia, EDHS, 2016

Characteristics	Cases, n (%)	Controls, n (%)	Odds Ratio and 95% CI	
			Crude	Adjusted
Place of Residence				
Urban	74(33.0)	66(14.7)	2.86(1.95-4.18)	2.63(1.29-5.34)*
Rural	150(67.0)	382(85.3)	1	1
Mother's Highest Educational Level				
No education	120(53.6)	286(63.8)	0.42(0.20-0.89)	1.41(0.44-4.51)
Primary	64(28.6)	125(27.9)	0.51(0.24-1.11)	0.85(0.31-2.32)
Secondary	25(11.2)	22(4.9)	1.14(0.45-2.84)	1.05(0.38-2.94)
Higher	15(6.7)	15(3.3)	1	1
Frequency of Reading Newspapers/ Magazines				
Not at all	195(87.1)	420(93.8)	0.12(0.03-0.42)	0.26(0.06-1.11)
Less than a week	17(7.6)	25(5.6)	0.17(0.04-0.69)	0.17(0.04-0.78)
At least a week	12(5.4)	3(0.7)	1	
Frequency of Listening Radio				
Not at all	155(69.2)	351(78.3)	0.65(0.41-1.01)	
Less than a week	30(13.4)	40(8.9)	1.10(0.59-2.05)	
At least a week	39(17.4)	57(12.7)	1	
Frequency of Watching TV				
Not at all	158(70.5)	372(83.0)	0.35(0.23-0.55)	0.69(0.32-1.53)
Less than a week	12(5.4)	31(6.9)	0.32(0.15-0.70)	0.42(0.17-1.05)
At least a week	54(24.1)	45(10.0)	1	1
Wealth Index				
Poorest	61(27.2)	162(36.2)	0.43(0.28-0.66)	1.22(0.55-2.68)
Poorer	27(12.1)	78(17.4)	0.39(0.23-0.67)	1.1(0.51-2.86)
Middle	28(12.5)	68(15.2)	0.47(0.27-0.80)	1.45(0.62-3.40)
Richer	34(15.2)	56(12.5)	0.67(0.41-1.17)	2.02(0.88-4.61)
Richest	74(33.0)	84(18.8)	1	1
Children Ever Born				
Four and above	155(69.2)	243(54.2)	1.90(1.35-2.66)	1.20(0.62-2.32)
Greater than four	69(30.8)	205(45.8)	1	1
Sex of Child				
Boys	129(57.6)	215(48.0)	1.47(1.07-2.03)	1.56(1.10-2.22)*
Girls	95(42.4)	233(52.0)	1	1
BMI of Mother				
Under weight	33(14.7)	84(18.8)	0.46(0.26-0.82)	0.91(0.47-1.77)
Normal weight	146(65.2)	311(69.4)	0.55(0.36-0.86)	0.94(0.54-1.62)
Overweight/ obese	45(20.1)	53(11.8)	1	1

Birth Rank				
Low birth rank (1-3)	141(62.9)	218(48.7)	1.79(1.29-2.49)	1.3(0.67-2.51)
High birth rank (> 3)	83(37.1)	230(51.3)	1	1
Age of Child				
Less than 6 months	46(20.5)	43(9.6)	3.18(1.98-5.10)	3.40(2.05-5.64)*
6-24 months	78(34.8)	108(24.1)	2.15(1.48-3.10)	2.40(1.61-3.58)*
24-59 months	100(44.6)	297(66.3)	1	1