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Overweight and obesity trends and association with household wealth index among children aged 5 to 19 years in Ethiopia a multilevel analysis of 2016 EDHS data

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Globally, an estimated 2.6 billion people, or 38%, are overweight or obese; the prevalence of obesity alone is anticipated to be 14%, or nearly 2 billion adults, children, and adolescents, by 2020. In addition, in 2035, the yearly worldwide economic cost of overweight and obesity will be $4.32 trillion if preventive and treatment strategies remain unchanged. This is equivalent to the impact of COVID-19 in 2020, about 3% of global gross domestic product (GDP). As a result, this study aimed to determine the association between the household wealth index and overweight and obesity in children over five in Ethiopia. A community-based cross-sectional study was conducted and data collection from a nationally representative sample of the 2016 Ethiopia Demographic and Health Survey (EDHS). The data collection was conducted from January to June 2016. The total sample of 20,584 children and adolescents aged 5 to 19 years old was utilized in the analysis. The overweight/obesity was measured by the weight-for-height (WFH) index, more than two standard deviations (+2 SD) above the median of the reference population based on the BMI Z-score. Multivariable logistic regression analysis was used to evaluate the predictors, and the findings were shown as an adjusted odds ratio (AOR) with a 95% confidence interval. At a p-value < 0.05, statistical significance was deemed to exist. Overall, out of 20,584 children aged 5 to 19 years, 2,336 (11.3%) were overweight or obese in Ethiopia. Factors such as maternal age greater than 40 years (AOR = 0.76, 95%CI: 0.67–0.89), mobile phone ownership (AOR = 1.36, 95%CI: 1.06–1.75), household use of solid fuel (AOR = 3.25, 95%1.66–6.37), middle wealth index (AOR = 1.47, 95% CI: 1.04–2.06), richest wealth index (AOR = 2.76, 95%CI: 1.59–4.81), regions lived in Afar (AOR = 0.28, 95%CI, 0.10–0.79), Gambela (AOR = 0.09, 95%CI, 0.03–0.24), Amhara (AOR = 3.27, 95%CI, 1.19–8.97), and Addis Ababa (AOR = 6.94, 95%CI, 1.36–12.68) were statistically significant with overweight and obesity among children older than five population in Ethiopia. This study pointed out factors such as maternal age, mobile phone ownership, household use of solid fuel, households having a middle and higher income, and living in Afar, Gambela, Amhara, and Addis Ababa are independent predictors of overweight and obesity among children older than five population in Ethiopia. As a result, a wide range of known contributing variables should be taken into account in programs aimed at reducing children's overweight and obesity.

Keywords Overweight, Obesity, Children, EDHS, Ethiopia

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Abbreviations

AOR	Adjusted odds ratio
BMI	Body mass index
CI	Confidence interval
COR	Crude odds ratio
CSA	Central statistics agency
EA	Enumeration areas
EMDHS	Ethiopian mini-demographic and health survey
EPHI	Ethiopian public health institute
FMoH	Federal Ministry of Health
GDP	Gross Domestic Product
ICC	Intraclass Correlation Coefficient
PHC	Population and Housing Census
SNNPR	Southern Nations Nationalities and Peoples Region
SSA	Sub-Saharan Africa
WHO	World Health Organization

Globally, an estimated 2.6 billion people worldwide were overweight or obese in 2020, and it is predicted that over 4 billion people may be afflicted, representing a 38 to over 50% rise in the global population. Out of those, it is predicted that the prevalence of obesity (BMI 30 kg/m2) alone would increase over the same time, impacting around 2 billion adults, children, and adolescents by 2035, from 14 to 24% of the population[1–3]. In other words, in 2035, the yearly worldwide economic cost of overweight and obesity will be $4.32 trillion if preventive and treatment strategies remain unchanged. This is equivalent to the impact of COVID-19 in 2020, at about 3% of global GDP[1,4].

The global public health community faces substantial challenges in the short and long term due to childhood and teenage obesity and overweight[5]. Obesity-related cardiovascular disease in children and adolescents is becoming more prevalent in conjunction with the rise in obesity and overweight.

Children who are overweight or obese run the risk of developing chronic health conditions such as diabetes, high blood pressure, dyslipidemia, asthma, sleep apnea, orthopedic issues, psychological problems, and premature death. These conditions can also result in long-term health consequences and disability[6–9]. Evidence supports the correlations between the family wealth index and overweight and obesity[10,11]. These correlations might be explained by increased intake of processed foods, high-saturated-fat foods, high-sugar foods, and high-sodium meals, all of which contribute to overweight and obesity[12–14].

The prevalence of overweight and obesity has increased in many developing and low-income countries, including Ethiopia[15]. The prevalence of obesity among children in Africa will see a major increase from 5 to 14%. For African women, the prevalence of obesity is anticipated to rise to 31% from 18% by 2035[3]. The annual increase in the child obesity rate in Africa is highest in Egypt (31.4%), Ghana (8.7%), and Angola (8.5%), followed by Rwanda, Tanzania, and Uganda, where the rate is 8.4%[3,16]. As per available literature from local studies in Ethiopia, the prevalence of overweight and obesity is significant and continues to rise across all age categories[15]. According to EDHS 2016, overweight or obese women rose from 3% in 2000 to 8% in 2016[17]. Additionally, according to the Ethiopian Demographic and Health Survey report, between 2011 and 2016, the prevalence of obesity or overweight rose among under-five children, women aged 15 to 49, and males aged 15 to 49, respectively, from 2 to 2.8%, 6–8%, and 2–3%[18]. Ethiopia's total childhood overweight prevalence has increased from 1.7 to 3.6%, according to the UNICEF 2017 annual report[19]. Moreover, the prevalence of overweight and obesity varies by region in Ethiopia[20]. For example, in a study conducted in Wolaita Sodo town, 5.0%[21], 13.3% in Jimma town[22], 12.5% in Bahir Dar[23], 13.8% in Gondar[24], and 9.8% in Addis Abeba[25] were found.

The disparity between the major drivers' estimates of obesity and overweight is warranted since it is related to a variety of factors, including maternal socioeconomic status, education, marital status, maternal smoking during pregnancy, parental BMI, birth weight, birth order, place of residence, gender, and dietary variables[26,27].

Despite significant efforts to reduce the Ethiopian children's obesity epidemic over the past two decades, it is still uncertain, and there is a paucity of information with robust statistical analysis given the clustering of data and the hierarchical nature of the variables. In other words, the previous studies conducted in Ethiopia among children aged 5–19 years have mainly surveyed studies; the extent of the variation within and between regional childhood overweight and obesity in Ethiopia and the determinant factors for the variation across regions were not well known. Moreover, the assumptions of independence among individuals within the same clusters and of equal variance across clusters are biased in the case of studies of grouped data. Hence, a multilevel analysis is the appropriate statistical analysis method for such a nationwide study. The government's and stakeholders' unwavering commitment to promoting and amplifying the effects of overweight and obesity, as well as the causes that contribute to their prevalence, remain unabated. Moreover, to the best of the scientists' knowledge, Ethiopia has very little recorded data about overweight and obesity, as well as the variables that are linked to these conditions. There is a dearth of information on the association between the household wealth index and overweight and obesity in children over the age of five in Ethiopia. As a result, this study assessed the association of the household wealth index with overweight and obesity among children aged 5–19 years in Ethiopia of a multilevel analysis of 2016 EDHS data. Thus, this finding could be an input in designing effective preventive strategies to alleviate the rising burden of early childhood overweight or obesity and its consequential morbidity and mortality in children's lives.

Methods and materials

Study design, setting, and period

A community-based cross-sectional study was conducted and data collection from a nationally representative sample of the 2016 Ethiopia Demographic and Health Survey (EDHS). The information was mostly gathered from January 18, 2016, to June 27, 2016. Ethiopia is located in northeastern Africa between 30 and 150 north latitudes and 330 and 480 east longitudes. The country has nine regional states (Amhara, Oromia, Tigray, Benishangul-Gumuz, Somalia, Afar, Harari, Southern Nations Nationalities and Peoples (SNNPR), and Gambella) and two city administrations (Addis Ababa and Dire Dawa)[28,29]. Estimates for rural and urban regions were produced at the national and regional levels by the survey, which was carried out with a nationally representative sample.

Sampling procedures and population

Rural-urban regions were utilized as strata in the EDHS's two-stage sampling, a random sample of clusters is selected, and then a simple random sample is selected from the units in each sampled cluster sampling strategy. Using independent selection in each sample stratum, enumeration areas (EAs) were chosen in the first stage with a probability proportionate to the EA size. An equal chance of systematic selection was used to choose the right number of homes per cluster in the second step. This study utilized a total sample of 20,584 children and adolescents aged 5 to 19 years old in the analysis, which was extracted from the EDHS survey. The EDHS measured the weight and height of children and/or adolescents in all sampled families who were older than five years old to get information on the nutritional condition of the children. Children who were older than five had their standing heights measured. The EDHS 2016 report contains further details about the survey's questionnaire and sampling strategy in general[30]. Data sets for children older than five were downloaded from the MEASURE DHS website. From the data sets, anthropometric information and numerous relevant socio-demographic characteristics were retrieved.

Data source

Before downloading the data, an approval letter was obtained from the DHS, and then the dataset was downloaded from the DHS website (http://www.dhsprogram.com). The children's record dataset was used from the downloaded datasets. Anthropometric data of under-five children and various pertinent socio-demographic variables were extracted from the datasets. The nutritional status of children aged 5–19 years was measured using the weight-for-height (WFH) index. The WFH index was later categorized into normal weight (above minus two standard deviations (− 2 SD) and below plus two standard deviations (+ 2 SD) from the median of the reference population), severely wasted (below minus 3 (− 3 SD) from the median reference population), moderately or severely wasted (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) based on the BMI Z-score[31] (1, 12, 16).

Study variables and measurements

Outcome variables: Outcome variables: overweight and obesity for children aged between 5 and 19 years; overweight is a BMI-for-age greater than 1 standard deviation above the WHO Growth Reference median; and obesity is greater than 2 standard deviations above the WHO Growth Reference median[2]. The merged data sets resulted in a smooth transition at 5 years for height-for-age, weight-for-age, and BMI-for-age. For BMI-for-age across all centiles, the magnitude of the difference between the two curves at age 5 years is mostly 0.0 kg/m² to 0.1 kg/m². At 19 years old, the new BMI values at + 1 standard deviation (SD) are 25.4 kg/m² for boys and 25.0 kg/m² for girls. These values are equivalent to the overweight cut-off for adults (≥ 25.0 kg/m²). Similarly, the + 2 SD value (29.7 kg/m² for both sexes) compares closely with the cut-off for obesity (≥ 30.0 kg/m²)[32]. By combining the two results, the combined prevalence of obesity and overweight was found.

Independent variables are variables like maternal and/or paternal education, maternal age, residence, and wealth index were evaluated based on 2016 EDHS data. The educational level of participants was categorized as no education, primary, secondary, and higher education[33].

Wealth index households with a wealth index of twenty, forty, sixty, eighty and hundred percentiles are assigned to poorest, poorer, medium, rich, and richest by merging the poorest and poor wealth index households as poor; the middle wealth index households as middle-class; and the rich and richest wealth index households as rich[30,34].

Statistical analysis

The data analysis process began with a synopsis of the socio-demographic variables. Frequency distribution analysis was used to determine the prevalence of overweight and obesity in children and adolescents older than five years old. The DHS provided a weighting factor. Weighting was used because of possible disparities in response rates and the non-proportional allocation of the sample to different regions, including urban and rural areas. A complex survey sampling technique was used to analyze the weighted data. We conducted significance tests and associations between the response and explanatory variables based on these assumptions. To quantify the significant associations, OR with a 95% confidence interval [CI] was used. The data were analyzed using STATA version 14 statistical software. Before doing any statistical analysis, the data were weighted using sample weight, the primary sampling unit, and strata to guarantee the survey's representativeness and to take the sampling design into account when computing standard errors to provide accurate statistical estimations.

The chi-square and multicollinearity assumptions of logistic regression were examined in order to ascertain the association between the household wealth index and overweight and obesity, as well as control confounders. The presumptions of independent observations and uniform variance among clusters were violated because individuals within a cluster shared characteristics. It is crucial to overcome the broken independence assumption

and account for the variability between clusters in multi-level advanced statistical modeling in order to guarantee the correctness of the standard error and unbiased estimate.

P-values of 0.20 indicated that the variables may be used in a multivariable, two-stage mixed-effects logistic regression. A bi-variable multilevel mixed-effect logistic regression model was constructed for each independent variable. The four distinct mixed-effect models that were fitted. The information criterion (AIC and BIC) of the mixed-effect model that had the lowest values was selected. If a factor's p-value was less than 0.05, it was considered a significant predictor of obesity and overweight. Using a 95% confidence interval, the odds ratio was utilized to assess the strength of the correlation. To estimate the relationship between the wealth index and the explanatory factors, the fixed effects sub-model was employed. The measure of cluster variation used was the intra-cluster correlation coefficient (ICC) with standard deviation. Four further models were fitted: a null model (a model without independent variables), a model considering just individual-level factors, a model including community-level variables, and a fourth model using both individual and community-level variables. Using the Akaike and Bayesian Information Criteria (AIC and BIC), the best-fitting model among the fitted models was eventually selected.

Results

Socio-demographic characteristics of the household

A total of 20,584 households with individuals aged 5 to 19 years were included in this study. Proportionally, the total sample included Ethiopian regions and city administrations. Accordingly, 3222 (14.9%), 3002 (13.9%), 2754 (12.8%), 2347 (10.9%), and 2170 (10.1%) of the households were enrolled from Oromia, SNNPR, Somalia, Amhara, and Tigray, respectively. The rest of the households included Afar, Benishangul Gumuz, Gambella, Harari, Addis Ababa, and Dire Dawa. The majority, 17,897 (82.8%) of the population, were from rural areas of Ethiopia. Nearly three-fourths of the participants had no formal education. Three-fourths of the interviewed people were males. Nearly one-third of the households had the poorest wealth index status. Nearly half of the participants were Muslims, 10,193 (47.3%), while 6798 (31.6%) were Orthodox religious followers (Table 1).

Household and individual characteristics

Out of a total of 20,584 households with individuals aged 5 to 19 years, 2336 (11.3%) of them were overweight or obese in Ethiopia (Fig. 1).

Nearly one out of every five people owned a mobile phone, while about 2033 households used the internet for different purposes. The majority of the households did not watch TV. The majority, 19,734 (95.8%), of households used solid fuel, while only 4.2% of them used clean fuel. About 865 (4.2%) of the households were covered by health insurance (Table 2).

Association of household wealth index and obesity/overweight

In the bivariable analysis, variables with a P-value of less than 0.2 were transformed into multilevel multivariable logistic regression. Finally, overweight and obesity among the 5 to 19-year-old population in Ethiopia, maternal age, household solid fuel use, wealth index, mobile phone ownership, and regions were statistically significant with overweight and obesity among children aged 5–19 years in Ethiopia.

The likelihood of being overweight or obese was 24% less likely to occur among children born from mothers who were older than 40 compared to their counterparts (AOR = 0.76, 95% CI: 0.67–0.89).

The odds of developing overweight and obesity were 3.25 times higher among households that used solid fuel compared to those that used clean fuel for cooking and heating purposes (AOR = 3.25, 95% CI: 1.66–6.37).

The likelihood of being overweight or obese was higher among middle-class (AOR = 1.47, 95% CI: 1.04–2.06) and rich (AOR = 2.76, 95% CI: 1.59–4.81) children whose families had the poor family wealth index. The children who owned mobile phones were overweight and obese 36% times higher than those who had no mobile phones (AOR = 1.36, 95%CI, 1.06–1.75).

The children who lived in Afar (AOR = 0.28, 95% CI: 0.10–0.79) and Gambela (AOR = 0.09, 95% CI: 0.03–0.24) were less likely to develop overweight and obesity, while those who lived in Addis Ababa (AOR = 6.94, 95% CI: 1.36–12.68) were compared to those in Tigray (Table 3).

Discussion

This study was carried out to determine the association between household wealth index and obesity/overweight among children older than 5 years in Ethiopia using country-level 2016 EDHS data. The study pointed out that overweight and obesity among the 5 to 19-year-old population in Ethiopia, maternal age, mobile phone ownership, household solid fuel use, and regions were statistically significant with overweight and obesity among children older than 5 and population in Ethiopia.

In the final model of multivariable analysis, those children born from mothers whose maternal age was greater than 40 were found to be statistically significant for overweight and obesity. Accordingly, when compared to women whose age was less than 40 years, being in an age range greater than 40 years decreased the likelihood of being overweight or obese by 24%. This is in harmony with the study conducted in Australia[35] and England[36], where maternal age was vividly associated with that of BMI. One possible justification could be related to the fact that those mothers whose age is greater than 40 probably have ample experience and knowledge of feeding a balanced and healthy diet to their children and adolescents. Moreover, as the age of the mother increases, her maturity and probably also her educational status increase, which in turn opens a way and a window of opportunity for healthy ways of nurturing their offspring. However, a study conducted in Taiwan showed that the age of the mother has nothing to do with the child's body mass index[37].

Variable	Category	Frequency	Percent
Region	Tigray	2170	10.1
	Afar	1748	8.1
	Amhara	2347	10.9
	Oromia	3222	14.9
	Somali	2754	12.8
	Benishangul Gumuz	1942	9
	SNNPR	3002	13.9
	Gambella	1388	6.4
	Harari	1071	4.9
	Addis Ababa	734	3.4
	Dire Dawa	1147	5.3
Place of residence	Urban	3698	17.2
	Rural	17,827	82.8
Religion	Orthodox	6798	31.6
	Catholic	114	0.5
	Protestant	4101	19
	Muslim	10,193	47.3
	Traditional	190	0.9
	Others	129	0.6
Sex of the household head	Male	16,197	75.2
	Female	5328	24.8
Educational level	No education	16,436	76.4
	Incomplete primary	3713	17.2
	Complete primary	273	1.3
	Incomplete secondary	523	2.4
	Complete secondary	230	1.1
	Higher	350	1.6
Household wealth index	Poorest	7505	34.8
	Poor	3542	16.4
	Middle	3220	14.9
	Rich	3151	14.6
	Richest	4107	19.1
History of cigarette smoking in the family	Yes	292	1.4
	No	21,233	98.6

Table 1. Socio-demographic characteristics of the households.

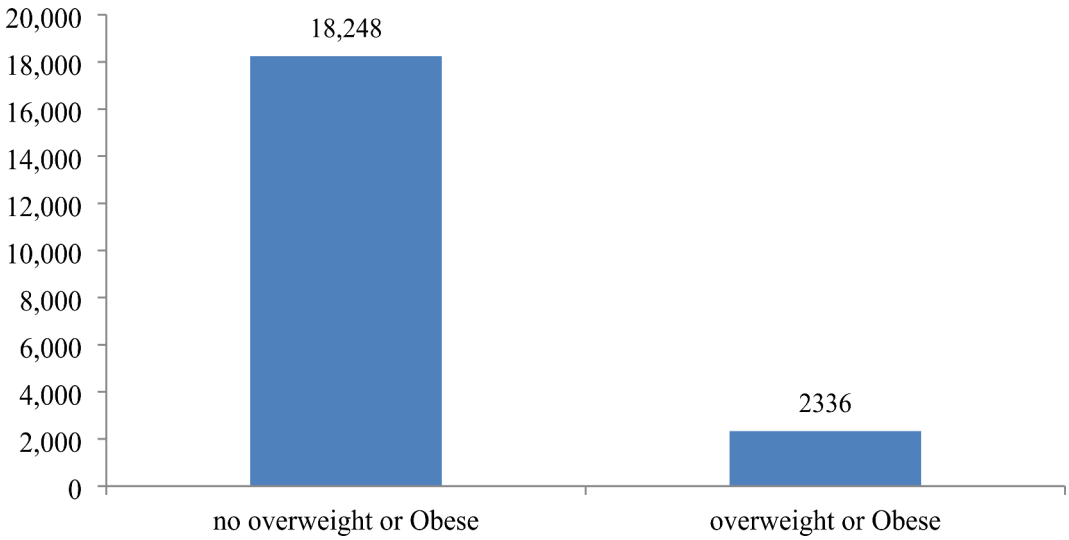

Fig. 1. The distribution of overweight and obesity among individuals who age 5 to 19 years in Ethiopia.

Variable	Category	Frequency	Percent
Frequency of watching TV	Not at all	16,738	81.3
	Less than once per week	1740	8.4
	At least once a week	2106	10.2
Own mobile phone	No	16,578	80.5
	Yes	4006	19.5
Use internet	Never	20,351	98.8
	Once per week	201	0.9
	At least twice a week	32	0.2
Household fuel use	Clean	850	4.1
	Solid	19,734	95.8
Household level insurance	Not covered	19,719	95.8
	Covered	865	4.2
Maternal age	Under 40	14,364	69.8
	40 and above	6220	30.2

Table 2. Maternal and child characteristics in Ethiopia from EDHS 2016.

According to this study, having clean fuel had a statistically significant association with the household wealth index as compared to its counterparts. Thus, the odds of developing overweight and obesity were 3.25 times higher among households that used solid fuel than those that used clean fuel for cooking and heating purposes. This is in line with the study conducted in Ghana[38] and China[39–41]. A possible justification could be that those who use solid fuels in the home may raise the risk of developing cardiometabolic diseases, such as obesity and overweight, as well as mortality through the aforementioned pathways. Incomplete burning of solid fuels also results in the production of black carbon, a component of PM, which is also associated with an increased incidence of non-communicable diseases. According to epidemiological data, there is a favorable correlation between obesity and belly fat and cardiometabolic disease[42,43]. The consequences of air pollution on cardiovascular health, both over the long term and in the short term, may be more pronounced in obese populations[44,45]. In fact, compared to people of normal weight, the antioxidant defense of the obese population is weaker[43]. It is believed that obesity is a chronic inflammatory and oxidative stress state[46], and the buildup of visceral fat causes changes in the metabolism of glucose and lipids, as well as pro-oxidant and pro-inflammatory states[43]. It is believed that oxidative stress is exacerbated by air pollution[47] and systemic inflammation[48]. According to earlier research, the obese group showed the highest correlations between air pollution and elevations in inflammatory markers when compared to the normal weight population[49]. Thus, the relationship between home air pollution and the prevalence of cardiometabolic diseases may be strengthened by obesity. The fact that the population health effects of household air pollution increased with the rising prevalence of obesity, even if ambient concentrations remained stable, may explain why obese people may be more vulnerable to the health effects of air pollution on cardiometabolic diseases[45]. Smoking solid fuel leads to an increase in oxidative stress, which is explicitly related to obesity[50,51]. Another reasonable theory is that exposure to solid fuels while cooking and heating might have overlapping effects and cause health harm to people over time, which clearly also includes and combines obesity and overweight[52], which in turn plays a crucial and pivotal role in enhancing their likelihood of being overweight or obese.

This study pointed out that those children from the middle and richest wealth index had a higher probability of being overweight or obese as compared to their counterparts. Thus, those children who were from the middle and richest wealth quintiles had a 1.47 and 2.76 times higher likelihood of being obese or overweight. This finding is supported by different studies conducted in different parts of the world[53–55]. In contrast, results from meta-analyses showed that lower income was associated with subsequent obesity[56]. The possible reasons might be that those who have a lower income are fed junk food to avoid feelings of hunger and that unhealthy lifestyles and eating habits drag them to the worst effects of obesity and overweight. Furthermore, it is unequivocal that social epidemiological studies have found an inverse relationship between income, which is one measure of socioeconomic status, and obesity. However, this relationship can be interpreted in two ways: either as a sign of causation, where obesity is the cause of lower income, or as a result of lower income, explaining obesity as the cause of obesity instead of the result[57–59].

Furthermore, in this study, having a mobile phone was an independent predictor of obesity and overweight. Accordingly, the odds of developing overweight or obesity were 1.36 times higher among children who have a mobile phone than their counterparts. This finding is consistent with the studies conducted in China[60,61]. This could be because of the associated lifestyle changes while using a smartphone; they become physically less active. Similarly, screen exposure correlated with being overweight and obese. Children's increased smartphone viewing time is associated with a higher likelihood of obesity due to a sedentary lifestyle[62]. One possible justification could be that study participants who use smartphones spend their valuable and essential time on entertainment, which might hugely reduce their physical activity, especially outdoor physical activity, and lengthen their sedentary time, thus causing an increase in obesity status[61,63]. More importantly, those couch potatoes were predisposed to developing overweight and obesity[64,65]. Advertising also increases calorie intake and can lead viewers to choose an unhealthy diet[66]. Moreover, emerging evidence on smartphone use suggests that higher levels of smartphone

Variable	Model I (null model)	Model II AOR	Model-III AOR	Model-IV AOR (95%CI
Maternal age				
Under 40 years		1	1	1
40 and above		0.76(0.65–0.90)		0.76(0.67–0.89)*
Types of household fuels used				
Clean fuel		1		1
Solid fuel		2.42(1.24–4.71		3.25(1.66–6.37)*
Family member's smoking history				
Yes		1.65(0.99–2.74)		1.63(0.98–2.7)
No		1		1
Religion				
Orthodox		1		1
Catholic		1.23(0.39–3.87)		1.81(0.57–5.73)
Protestant		0.71(0.45–1.11)		1.02(0.63–1.66)
Muslim		0.58(0.37–0.90)		0.91(0.53–1.57)
Traditional		1.26(0.54–2.92)		1.78(0.76–4.15)
Other		0.87(0.34 – 0.18)		1.24(0.48–3.20)
Wealth index				
Poorest		1	-	1
poorer		1.46(1.11–1.92)	-	1.26(0.99–1.66)
middle		1.76(1.26–2.47)	-	1.47(1.04–2.06)*
richer		1.10(0.78–1.55)	-	0.87(0.61–1.22)
richest		4.14(2.46–6.96)	-	2.76(1.59–4.81)*
Mobile phone ownership				
No		1		1
Yes		1.33(1.04–1.72)		1.36(1.06–1.75)*
Watching a television				
Not at all		1		1
Once a week		0.77(0.54–1.10)		0.74(0.52–1.06)
At least twice a week		1.56(0.86–2.83)		1.32(0.74–2.35)
Internet use				
Not at all		1		1
Once to everyday		2.82(0.32–24.10)		2.50(0.27–22.80)
Residence				
Urban		-	1	1
Rural		-	1.41(1.22–1.63)*	0.61(0.28–1.31)
Region				
Tigray			1	1
Afar		-	1.61(1.28–2.11)	0.28(0.10–0.79)*
Amhara		-	1.36(1.1–1.6)	3.27(1.19–8.97)*
Oromia		-	1.1(0.87–1.31)	1.86(0.70–4.93)
Somali		-	1.27(1.03–1.5)	0.32(0.12–0.87)
Benishangul Gumuz		-	1.41(1.13–1.77)	2.25(0.76–6.69)
SNNPR		-	1.25(1.02–1.54)	2.66(0.96–7.41)
Gambella		-	1.17(0.92–1.49)	0.09(0.03–0.24)*
Harari		-	1.00(0.77–1.31)	1.68(0.45–6.26)
Addis Ababa		-	0.69(0.51–0.96)	6.94(1.36–12.68)*
Dire Dawa		-	1.62(1.25–2.10)	0.75(0.22–2.59)
Random effects				
Community variance	6(0.9)	5.66(0.8)	4.1(0.57)	5.6(0.8)
ICC%	67%	63%	55.3%	63.3%
Model comparison				
AIC	6300.1	6339.4	6300.2	6339.5
BIC	6404.4	6483.8	6404.5	6483.9

Table 3. A multilevel analysis of child mortality determining factors.

use are also associated with a greater decrease in physical activity[67], sedentary behaviors[68], and higher weight status and BMI within the population[69]. This may also highlight the need for further studies in this area.

Finally, this study pointed out that the dwelling region of the study population was found to be an independent predictor of obesity and overweight. Thus, those children who lived in Afar and Gambela were less likely to develop overweight and obesity (72% and 99.1%, respectively). Conversely, those children who lived in SNNPR, Addis Abeba, and Amhara were 2.66, 6.94, and 3.27 times more likely to develop overweight and obesity as compared to children who reside in the Tigray region. More importantly, obesity and overweight are civilizational diseases, and the proportion of people suffering from them continues to grow, especially in the advantageous areas[70–72]. The possible explanation for these results may be that people from various geographical areas may have diverse lives and adhere to distinct socioeconomic and cultural systems. For instance, the majority of individuals who live in remote areas lead pastoralist lifestyles. In addition, the Gambela region is relatively rich in fruit production; residents may consume more fruits and organic foods than people living in more modern Addis Ababa. These hot and dry climate conditions force pastoralist communities to move around constantly in search of grazing land and water. This results in high physical activity and less resting time and reduces their odds of having obesity and overweight. Conversely, the sedentary lifestyle and dietary habits of the Tigray region are the result of these disparities. More people here than in SNNPR, Addis Ababa, or Amhara have higher rates of obesity and overweight due to the improved socioeconomic standing of the population and easier availability of high-calorie foods. The study conducted in Ethiopia also reported that a habit of food eating and sedentary lifestyle is more closely associated with obesity and overweight risk factors[73]. However, further research may provide a clear explanation for these variances throughout Ethiopia's geographical areas.

Practice implications

The study's conclusions can be used to inform policymakers and other stakeholders about this new nutrition-related problem among household wealth indexers with overweight and obesity among children and to direct the creation of programs meant to prevent overweight and obesity in Ethiopia.

Strengths and limitations of the study

The study made use of a large survey, nationally representative data, regional variance, and individual and community-level characteristics. Nevertheless, this study has many shortcomings. Since the data are cross-sectional, it is impossible to determine a cause-and-effect relationship between the independent and dependent variables. This study excluded characteristics such as family size, number of children's feeding practices, children's dietary histories, the nutritional health of the mother, and the weight of the child at birth in order to concentrate solely on the particular causes of overweight and obesity. These might be the remaining sources of confusion. Stated differently, the process of gathering information like birth size and infection history relies only on the recollections of mothers or other caregivers, potentially leading to recall bias. This study evaluated data from seven years prior to the survey period; it may be subject to recall bias, especially when it comes to age or other retrospective data that depends on recollections of previous occurrences. Considering the aforementioned constraints, there are certain advantages to the current approach. First, inferences about Ethiopia may be made since the EDHS data is a nationally representative set of data. Second, because this type of survey uses defined techniques, the data is trustworthy and of excellent quality. Third, the links between the result variable and its determinants were investigated using the proper statistical approach.

Conclusions

This study pointed out factors such as maternal age, mobile phone ownership, household use of solid fuel, households having a middle and higher income, and living in Afar, Gambela, Amhara, and Addis Ababa are independent predictors of overweight and obesity among children older than five population in Ethiopia. As a result, a wide range of known contributing variables should be taken into account in programs aimed at reducing children's overweight and obesity.

Data availability

The Demographic and Health Survey (DHS) data set is available at (http://www.dhsprogram.com). The DHS Program is authorized to distribute, at no cost, unrestricted survey data files for legitimate academic research. Registration is a prerequisite for access to data. The data sets are publicly available to all registered users and can be downloaded from the website.

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Author contributions

IM and AB conceived and designed the study. IM, AD, MB, BG, MG, ADw, FM, HF, AE, LD, and AB drafted the manuscript and IM was the PI of the review. AD, IM, AB, and AE developed search strings. All reviewers (IM, AD, MB, BG, MG, ADw, FM, HF, AE, LD, and AB) screened and selected studies. IM, AE, LD, and AB extracted data and evaluated the quality of the studies. IM and AB performed analyses and interpretations. All authors have rigorously reviewed, read, and approved the final version of the manuscript.

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Declarations

Ethics approval and consent to participate

After registration, the data was retrieved from the webpage for the Demographic and Health Survey (DHS), which can be accessed at (http://www.dhsprogram.com). The only aim of the information collection was to carry out a research study. We did not reveal any specific families or individuals and kept all information confidential. EDH has received permission from the Ethiopian Health Nutrition and Research Institute (EHNRI) Review Board and the National Research Ethics Review Committee (NRERC) of the Ministry of

Science and Technology in Ethiopia. The obtained data were treated strictly as confidential and were used only for this study.

Competing interests
The authors declare no competing interests.

Additional information
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