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Determinants of overweight/obesity among reproductive age group women in Ethiopia: multilevel analysis of Ethiopian demographic and health survey

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ABSTRACT

Objective Overweight/obesity among women is associated with an increased risk of gestational diabetes, pre-eclampsia, postpartum haemorrhage, low birth weight, congenital malformation and neonatal deaths. Although the magnitude of overweight and obesity among the reproductive age group women is a common problem in Ethiopia, there are limited studies that determine the associated factors of overweight and obesity at the national level. Therefore, this study aimed to identify the determinant factors of overweight/obesity among reproductive age group women in Ethiopia.

Design Cross-sectional study design.

Setting Ethiopia.

Participants Non-pregnant women aged 15–49 years.

Primary outcome Overweight/obesity.

Methods The present study used the Ethiopia Demographic Health Survey (EDHS) data for 2016. A total of 10 938 non-pregnant reproductive age group women were included in the analysis. Both bivariable and multivariable multilevel logistic regression were performed to determine the determinants of overweight and obesity among women in Ethiopia. The OR with a 95% CI was estimated for potential determinants included in the final model.

Results Those women with secondary education (adjusted OR (AOR)=1.48, 1.01, 2.18), higher education (AOR=1.78, 1.13, 2.81), richer (AOR=1.85, 1.15, 2.98) and richest wealth index (AOR=3.23, 1.98, 5.29), urban residence (AOR=4.46, 2.89, 6.87), married (AOR=1.79, 1.21, 2.64), widowed (AOR=2.42, 1.41, 4.15), divorced (AOR=1.84, 1.13, 3.00), aged 25–34 years (AOR=2.04, 1.43, 2.89), 35–44 years (AOR=2.79, 1.99, 3.93) and 45–49 years (AOR=2.62, 1.54, 4.45) had higher odds of developing overweight and obesity.

Conclusion Women with higher education level, high wealth status, older age, formerly married and those urban dwellers had higher odds of overweight and obesity. Therefore, regular physical activity, reducing consumption of fat/energy-dense food as well as modifying the mode of transportation is recommended.

Strengths and limitations of this study

- The use of multilevel logistic regression model, a model that accounts the correlated nature of Ethiopia Demographic Health Survey data, enhances the accuracy of estimates.
- The use of nationally representative data that can enhance the generalisability of the findings.
- Due to the secondary nature of the data, the present study was limited by unmeasured confounders such as types of food that women eat, frequency of eating and physical activity. Therefore, we cannot assess the association of these variables with overweight and obesity.
- The cross-sectional nature of the survey does not allow the cause-and-effect relationship between independent variables and overweight/obesity.

INTRODUCTION

Overweight/obesity is a major public health problem affecting both developed and developing countries all over the world.[1 2] Individuals with overweight/obesity are at a major risk of developing non-communicable diseases such hypertension, coronary heart disease, type 2 diabetes mellitus, joint and muscular disorders, respiratory problems and cancer.[1 3–6] This impact of overweight and obesity is further devastating for women, since it is both affecting their health and also the health of their offspring.[7] Overweight and obese women are more vulnerable to complications associated with pregnancy and childbirth such as gestational diabetes, gestational hypertension, pre-eclampsia and postpartum haemorrhage, instrumental delivery and surgical site infection to themselves and low birth weight, congenital malformation,

preterm birth, large-for-gestational-age babies and perinatal death for the newborn.[7 8]

Overweight and obesity account for approximately 4.0 million deaths and 120 million disability-adjusted life-years globally.[9] The finding of systematic review and meta-analysis study indicates that the proportion of overweight/obesity among women worldwide ranges from 29.8% to 38.0%.[1] The trend of overweight and obesity is also increasing rapidly in developing countries following the development of their economies, decreasing levels of physical activity and the shifting diet to higher energy and fat dense food intakes.[2 10] For example, the prevalence of overweight and obesity among reproductive age group women was 57.4% in Uganda, 66.7% in Nigeria, 74.1% in Tanzania and 87% in South Africa.[11] According to the finding of some pocket studies in Ethiopia, overweight and obesity among reproductive age group women is also common. For instance, it was 56.2% in South region,[12] 26.7% in Dessie town,[13] 36.4% in Hawassa[14] and 20.6% in Addis Ababa.[15]

Regarding predictors of overweight and obesity: being female,[11 14 16] older age,[11 14 17 18] married,[11 13 17–19] having richer wealth index,[13 14 16–18 20] television watching,[15] no/light-intensity activities,[14 16 19] alcohol drinking,[13 14] eating snack,[13] frequent consumption of sweets, meat and eggs,[14] access to improved water source,[15] access to improved toilets,[17] higher education,[17 18 20] not working,[18] use of hormonal contraception[18] and urban in residence[17 19] were associated with an increased risk overweight and obesity.

Although the magnitude of overweight/obesity among reproductive age group women is a common problem in Ethiopia, there are limited studies on this aspect that identify determinants of overweight/obesity at the national level. Therefore, this study will help for health practitioners and policy-makers to the identification, implementation and evaluation of evidence-based interventions of the problem. It will also benefit the community by giving insight about the risk factors of overweight/obesity and refrain from these risk factors for the future.

METHODS

Data sources

The present study used the Ethiopia Demographic Health Survey (EDHS) 2016 (n=10 938), the recent Ethiopian demographic health survey to determine the associated factors of overweight/obesity among reproductive age group women (15–49 years) in Ethiopia.

EDHS is a survey designed to provide population and health indicators at the national and regional levels. It is collected using a structured, interviewer-administered questionnaire every 5 years.[21]

Sample size and sampling procedure

A two-stage stratified cluster sampling was used. Since Ethiopia has nine regional states and two city administrations, stratification was done by separating each structural division into urban and rural areas, except Addis Ababa (entirely urban). Therefore, a total of 23 sampling strata have been created. Then, each stratum was again further divided into enumeration areas (EAs; a geographic area consisting of 200–300 households, which served as a counting unit for the census) using the list of all EAs (clusters) prepared by the 2007 Population and Housing Census as a sampling frame.[22] In the first stage, a total of 645 EAs were selected. Of which, 202 were from urban areas. The EAs were selected with probability proportional to the EA size and with independent selection in each sampling stratum. In the second stage, a fixed number of 28 households per cluster were selected randomly from the household listing.[21] A total of 15 683 women (15–49 years) were interviewed, making up response rates of 95%. In the present study, a total of 10 938 non-pregnant, non-underweight reproductive age group women (15–49 years) were included.

Outcome variable

The outcome variable for this study was body mass index (BMI), which is dichotomised as normal and overweight/obesity. Individuals are found to have normal BMI when their BMI is from 18.5 to 24.9 kg/m^2. Those individuals with a BMI of ≥25 kg/m^2 were overweight and those with BMI ≥30 kg/m^2 were obese.[2] According to EDHS data height and weight, measurements were carried out on women aged 15–49 years in all selected households. Weight measurements were obtained using lightweight SECA mother–infant scales with a digital screen designed and manufactured under the guidance of UNICEF. Height measurements were carried out using a Shorr measuring board.[21]

Independent variables

The independent variables for this study were classified as individual, household level and community level factors. The individual and household level factors were age, marital status (labelled as single, married, divorced/separated and widowed), maternal occupation (working or not working), parity, maternal education (no education, primary education, secondary education, higher education), reading magazine, wealth index (poorest, poorer, middle, richer and richest), alcohol use, listening radio, watching television and contraceptive use (no, use traditional method, use modern method). The community-level factors include place of residence (urban or rural), community maternal education level (aggregate values of community-level maternal education measured by the proportion of women with a minimum of primary level of education derived from data on mothers level of education and categorised as low and higher education community) and community poverty level (proportion of women in the poorest and poorer quintile derived from data on wealth index which is categorised as low and high poverty community). The last two community-level factors are created by aggregating the selected individual and household level factors at the cluster level (not directly found

Table 1 Sociodemographic and information-related characteristics of reproductive age group women in Ethiopia (n=10 938), 2016

Variables	Frequency	Percent
Residence		
Urban	2678	24.48
Rural	8260	75.52
Age in years		
15–24	4112	37.59
25–34	3796	34.7
35–44	2292	20.96
45–49	738	6.75
Marital status		
Single	2848	26.04
Married	7038	64.34
Divorced/separated	729	6.67
Widowed	323	2.95
Educational status		
No education	5158	47.16
Primary education	3772	34.49
Secondary education	1368	12.50
Higher education	640	5.85
Wealth index		
Poorest	1666	15.23
Poorer	1900	17.38
Middle	2034	18.60
Richer	2171	19.84
Richest	3167	28.95
Alcohol consumption		
Yes	4032	36.86
No	6906	63.14
Contraceptive use		
No method	7770	71.04
Traditional method	59	0.54
Modern method	3109	28.42
Community education		
Low	4470	43.04
High	5916	56.96
Community poverty		
Low	6065	58.40
High	4321	41.60
Current work status		
Not working	7096	64.87
Working	3842	35.13
Parity		
0 children	3501	32.01
1–3 children	3462	31.65
≥4 children	3975	36.34
Frequency of listening television		
Not at all	7679	70.20
Less than once a week	1370	12.52
At least once a week	1889	17.28
Frequency of listening radio		
Not at all	7190	65.73
Less than once a week	1849	16.91
At least once a week	1899	17.36
Frequency of reading magazine		
Not at all	9394	85.88
Less than once a week	1093	10.00
At least once a week	451	4.12

in the Demographic Health Survey data). The aggregates were computed using the average values of the proportions of women in each category of a given variable. We used median values to categorise the aggregated variables into groups.

Data management and statistical analysis

The data were checked for completeness and weighted before doing any statistical analysis. The analysis was done using STATA V.14. A sampling weight was done to adjust for the non-proportional allocation of the sample to different regions and the possible differences in response rates. Hence, the actual representativeness of the survey results at both the national and regional levels is ensured. To choose the appropriate model for the study, first, we fit the null model to examine the between community variation and justify the use of multilevel analysis. Accordingly, the measures of community variation (random-effects) were estimated as the intraclass correlation coefficient (ICC) and the value was significant. Therefore, a multilevel logistic regression model is used instead of ordinary logistic regression. Model comparison was done using deviance. The comparison was done among the null-model (a model with no independent variables), model I (a model with only individual-level factors), model II (a model with only community-level factors) and model III (a model with both individual and community level independent variables). A model with the lowest deviance (model III) was selected. Both bivariable and multivariable multilevel logistic regression was performed to identify the determinants of overweight and obesity. All variables with a $p<0.2$ at bivariable multilevel logistic model analysis were entered into the multivariable multilevel logistic regression model. Variance inflator factor was employed for checking multicollinearity among the independent variables.

Table 2 Model comparison to determine the determinants of overweight and obesity among women

	Null model	Model 1	Model 2	Model 3
ICC	0.34 (0.29 to 0.38)	0.17 (0.12 to 0.23)	0.13 (0.96 to 0.18)	0.98 (0.71 to 0.14)
MOR	3.42 (3.13 to 4.06)	2.23 (1.93 to 2.64)	1.99 (1.79 to 2.23)	1.79 (1.29 to 2.03)
Log-likelihood	−4052.8172	−2794.9605	−2847.4853	−2701.6181
Deviance	8105.6344	5589.921	5694.9706	5403.2362

ICC, intraclass correlation coefficient; MOR, median OR.

Ethical consideration

We requested DHS Programme and permission was granted to download and use the data for this study from http://www.dhsprogram.com. The Institution Review Board approved procedures for DHS public-use data sets do not in any way allow respondents, households or sample communities to be identified. There are no names of individuals or household addresses in the data files. The geographic identifiers only go down to the regional level (where regions are typically very large geographical areas encompassing several states/provinces). Each EA (primary sampling unit) has a number in the data file, but their numbers do not have any labels to indicate their names or locations.

Patient and public involvement statement

Patients and the public were not involved in the design, or planning of this secondary data analysis. However, it is crucial for the initial data collection process because measurements like weight and height were collected from households to calculate their BMI.

RESULTS

Sociodemographic and information-related characteristics of the study participants

A total of 10 938 participants were included in the study. Majority of the participants, 7037 (64.3%) were married. Four thousand one hundred and twelve (37.59%) study participants were in the age range of 15–24 years. More than half of the study participants were from the community with high education, 5452 (50.15 %) and high poverty, 6032 (55.15%). The majority of study participants, 8260 (75.52%) were rural dwellers. Three thousand one hundred and sixty-eight (28.96%) of the participants were contraceptive users. Regarding substance use, 4032 (36.86%) of the respondents had a history of alcohol consumption. The majority of respondents had no history of listening television, 7679 (70.20%), listening radio, 7190 (65.73%) and reading magazine, 9394 (85.88%) (table 1).

Statistical analysis and model comparison

As we can see from table 2, the ICC in the empty model was 34 %, indicating that 34% of the total variability for overweight/obesity was due to differences between clusters/EA, with the remaining unexplained 66% which is attributed by individual differences. Moreover, the median OR (MOR) for overweight/obesity was 3.42 in the null model which indicates that there was variation between clusters. If we randomly select an individual from two different clusters, individuals at the cluster with a higher risk of overweight/obesity had 3.42 times higher odds of being overweight/obese as compared with individuals at cluster with a lower risk of overweight/obesity. The models were compared with deviance and model III (a model with both individual and community level factor) was selected, had the lowest deviance (5403.24) (table 2).

Determinants of overweight/obesity among women

On bivariable multilevel logistic regression analysis, age, marital status, education level, residence, community poverty, community education, contraceptive use, wealth index and alcohol use were associated with overweight/obesity ($p<0.25$). However, in the final model: age, marital status, education level, residence and wealth index were significantly associated with overweight/obesity among women in Ethiopia ($p\leq0.05$).

The odds of overweight/obesity among urban women were higher compared with women in the rural area (AOR=4.46, 95% CI=2.89 to 6.87). The odds of overweight/obesity were higher among women with secondary education (AOR=1.48, 95% CI=1.01 to 2.18) and higher education (AOR=1.78, 95% CI=1.13 to 2.81) compared with non-educated once. Women who were married (AOR=1.79, 1.21 to 2.64), widowed (AOR=2.42, 1.41 to 4.15) and divorced (AOR=1.84, 1.13 to 3.00) had higher chance of being overweight/obese compared with singles. Those women who were in the age group of 25–34, 35–44 and 45–49 years had 2.04 (AOR=2.04, 1.43 to 2.89), 2.79 (AOR=2.79, 1.99 to 3.93) and 2.62 (AOR=2.62, 1.54 to 4.45) times higher chance of being overweight/obese compared with those who had 15–24 years of age, respectively.

The likelihood of overweight/obesity among richer (AOR=1.85, 1.15 to 2.98) and richest women (AOR=3.23, 1.98 to 5.29) was higher compared with the poorest women (table 3).

DISCUSSION

This study used a multilevel logistic regression model to identify the determinants of overweight/obesity among reproductive age group women in Ethiopia. Accordingly,

Table 3 Bivariable and multivariable multilevel logistic regression analysis to determine associated factors of overweight/obesity among women in Ethiopia, 2016

Variables	Overweight/obesity		OR	
	Yes N (%)	No N (%)	COR (95% CI)	AOR (95% CI)
Age in years				
15–24	233 (5.66)	3879 (94.34)	1	1
25–34	424 (11.17)	3372 (88.83)	2.90 (2.47 to 3.40)	2.04 (1.43 to 2.89)*
35–44	307 (13.38)	1985 (86.62)	4.54 (3.82 to 5.38)	2.79 (1.99 to 3.93)*
45–49	95 (12.91)	643 (87.09)	5.10 (3.99 to 6.47)	2.62 (1.54 to 4.45)*
Residence				
Rural	675 (25.22)	7877 (95.36)	1	1
Urban	383 (4.64)	2002 (74.78)	7.11 (5.95 to 8.51)	4.46 (2.89 to 6.87)*
Education level				
No education	307 (5.95)	4851 (94.05)	1	1
Primary education	356 (9.45)	3416 (90.55)	1.09 (0.93 to 1.28)	1.28 (0.99 to 1.65)
Secondary education	215 (15.69)	1153 (84.31)	1.49 (1.22 to 1.80)	1.48 (1.01 to 2.16)*
Higher education	181 (28.24)	459 (71.76)	1.71 (1.36 to 2.14)	1.78 (1.13 to 2.81)*
Community-level education				
Low	217 (3.98)	5236 (96.02)	1	1
High	842 (15.34)	4644 (84.66)	3.92(3.11 to 4.94)	1.34 (0.95 to 1.87)
Community poverty				
High	217 (4.42)	4689 (95.58)	1	1
Low	842 (13.96)	5191 (86.04)	4.55(3.62 to 5.72)	0.67 (0.44 to 1.01)
Marital status				
Single	214 (7.50)	2635 (92.50)	1	1
Married	690 (9.80)	6348 (90.20)	2.82 (2.41 to 3.30)	1.79 (1.21 to 2.64)*
Widowed	62 (19.29)	261 (80.71)	3.67 (2.63 to 5.14)	2.42 (1.41 to 4.15)*
Divorced	93 (12.78)	636 (87.22)	3.10 (2.46 to 3.91)	1.84 (1.13 to 3.00)*
Wealth index				
Poorest	64 (3.83)	1602 (96.17)	1	1
Poorer	67 (3.53)	1834 (96.47)	0.79 (0.57 to 1.10)	1.04 (0.63 to 1.71)
Middle	67 (3.29)	1968 (96.71)	0.83 (0.59 to 1.16)	1.16 (0.70 to 1.92)
Richer	123 (5.65)	2048 (94.35)	1.52 (1.14 to 2.03)	1.85 (1.15 to 2.98)*
Richest	738 (23.31)	2429 (76.69)	6.38 (5.11 to 7.96)	3.23 (1.98 to 5.29)*
Alcohol use				
No	636 (9.21)	6270 (90.79)	1	1
Yes	423 (10.48)	3610 (89.52)	1.12 (0.96 to 1.29)	0.96 (0.78 to 1.17)
Contraceptive use				
Not used	715 (9.20)	7055 (90.80)	1	1
Traditional method	17 (29.48)	42 (70.52)	1.69 (0.99 to 2.87)	1.11 (0.49 to 2.53)
Modern method	326 (10.49)	2783 (89.51)	1.47 (1.28 to 1.69)	0.88 (0.68 to 1.14)

*p≤0.05.
AOR, adjusted OR; COR, crude OR.

the individual-level factors such as age, marital status, education level of the women and wealth index were significantly associated with overweight/obesity. From community-level factors, the residence of the study participant was significantly associated with overweight/obesity.

The odds of overweight/obesity among urban women were 4.46 times higher compared with women in the rural

area. This implies that a huge number of urban residents are affected by the problem, requiring urgent intervention such as changes in bad eating habits and sedentary lifestyles to alleviate the risk of overweight and obesity. The current finding is similar to studies in Ethiopia, Iran and Ghana.[17 19 23 24] The possible plausible reason for the disparities of overweight and obesity between rural and urban women might be in the rural areas, women mostly engaged in agricultural and other activities, which are physical and therefore unlikely to gain as much weight as the urban women. Moreover, women in rural areas are less exposed to western lifestyle such as sedentary life, changing modes of transportation, reduced physical activity and eating packed fat as well as energy-dense food items.[25]

The odds of overweight/obesity among married, widowed and divorced women were higher compared with single women. This might be explained by single women unlike their married or widowed or, divorced counterparts are less likely to be multiparous, as multipara women are at greater risk of weight gain during pregnancy and the puerperium period.[6 26] Another possible justification could be because these single women are more likely to be younger, they have decreased risk of overweight/obesity compared with married, widowed and separated once.

The odds of overweight/obesity among women aged 25–34, 35–44, 45–49 years was higher compared with women with age group of 15–24 years. This finding is similar with many studies conducted elsewhere.[23 24 27–29] This could be due to a change in body composition such as an increase and redistribution of body fat and hormonal changes following increment of age, which are accompanied by a less active lifestyle, leading to an increased risk of overweight and obesity among aged women.[30]

The odds of overweight/obesity among women with secondary and higher education were higher than women with no education. Women with richer and richest wealth index had also a higher chance of being overweight and obese compared with women with the poorest wealth index. This finding is in line with the finding of many studies elsewhere.[23 27 29 31–35] The increased risk of overweight or obesity among women with higher education and high wealth index status might be related to changing nutritional and lifestyle trends, consumption of high-calorie and fat diets and less physical activity habits in these groups. As developing countries context like Ethiopia, the wealthier and those individuals who had higher education are more likely to consume energy-dense foods and follow a sedentary lifestyle; hence, they are more likely to be overweight and obese compared with their counterparts.[6 20 24 36]

Based on the findings of our study, policy interventions addressing food system drivers of caloric overconsumption and improving physical activity habit are essential to address overweight and obesity among reproductive age group women.

CONCLUSION

Women with higher education levels, wealth status, older age and those urban dwellers had higher odds of overweight/obesity. Those women who were married, divorced and widowed had also a higher chance of the problem. Therefore, there is a need for interventions to reduce the risk of death due to non-communicable diseases following overweight/obesity among women through improving their diet (consuming less fatty food items) and doing regular physical activity.

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Contributors YY conceptualised, designed, reviewed literatures, extracted and analysed data for the study. SAK, AML, GAT, CDA, ABT and AZA analysed data and reviewed the manuscript. YY and GAT drafted the manuscript. All authors read and approved the final manuscript.

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Patient consent for publication Not required.

Ethics approval DHS Programme granted the permission to download and use the data for this study from http://www.dhsprogram.com. The Institution Review Board approved procedures for DHS public-use data sets do not in any way allow respondents, households or sample communities to be identified. There are no names of individuals or household addresses in the data files. The geographic identifiers only go down to the regional level (where regions are typically very large geographical areas encompassing several states/provinces). Each EA (primary sampling unit) has a number in the data file, but their numbers do not have any labels to indicate their names or locations.

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