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Wealth index and other behavioral and sociodemographic characteristics associated with body mass index in Ethiopia

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Abstract

Background: Nowadays, the burden of non-communicable diseases including obesity has been an increasing public health concern. This menace can be monitored using indexing method like body mass index. Studies indicate that socioeconomic indicators such as income, biology, behavior, and demographic factors associated with body mass index. In Ethiopia, few studies associate wealth index with body mass index in people of ages between 15 and 49. This study was aimed to assess the association of body mass index with wealth index, and behavioral and sociodemographic population characteristics.

Methods: A cross-sectional population-based study was conducted using the 2016 Ethiopian Demographic and Health Survey population of ages 15–49. A total of 10,245 individuals were considered to detect the effect of socioeconomic, biological, behavioral, and demographic factors on body mass index using logistic regression.

Results: The prevalence of underweight, overweight, and obesity among men are 23.8%, 6.6%, and 2.0%, respectively, which is lower than that of women (underweight 25.3%, overweight 9.1%, and obesity 2.9%). The poorest men had higher odds of being underweight (adjusted odds ratio = 2.395%; 95% confidence interval = 2.020–3.544) as compared to the richest men. Merchants and government employees have lower odds (adjusted odds ratio = 0.744; 95% confidence interval = 0.588–0.899) compared to men whose occupation is farming and labor, indicating that merchants and government employees are more likely to become overweight and obese compared to men who are farmers and laborers.

Conclusion: It is concluded that wealth index is an important socioeconomic determinant of body mass index among men and women of age 15–49 in Ethiopia. A high prevalence of underweight, and overweight, and obesity is observed, which increases instances of non-communicable diseases. Effects of socioeconomic, biological, behavioral, and demographic indicators on body mass index differed according to sex.

Keywords

BMI, logistic regression, wealth index, associated factors, Ethiopia

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Introduction

Wealth index is a key factor shaping the well-being of humans that results in different body mass index (BMI) score.[1] BMI reflects body fat distribution and upper body adiposity.[2,3] Strong direct relationship exists between socioeconomic status and non-communicable diseases such as obesity.[4] Between 2005 and 2008, World Health Organization (WHO) estimates showed that at least 400 million and 1.4 billion adults of age 20 and older were overweight. Globally, at least 2.8 million adults die each year because of overweight and obesity.[5–7] In most countries, the BMI has increased gradually parallel to the rise in the number of city inhabitants. While it is widely reported that urbanization is an important driver of the global increase in obesity, sometimes for developed countries the reverse is true.[8,9] Studies from Africa indicate high prevalence of overweight/obesity among women and men,[10] while low BMI widely prevailed in Ethiopia, in the range of 33%–43%.[11] Strong inverse relationship was observed between biological aging and economic, social, and chronological aging. During old age, fatty and connective tissue in the body increases, and body water levels and muscle tissues decrease.[12]

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A study on African migrants to developed countries suggested that in African migrants, lack of parental supervision and discipline is related to adolescent BMI.[13] This has an implication that marital status is one of the factors associated with adolescent BMI. The findings from seven African countries involving participants aged 11–17 years suggest that the prevalence of both overweight and underweight was relatively high, demonstrating the existence of the double burden of malnutrition among adolescents in developing countries.[14,15]

In developing countries, particularly in Sub-Saharan African countries, socioeconomic and behavioral factors are associated with BMI. In this regard, a study conducted in Nairobi, Kenya, reported that for urban men and women, aged 40–60 years, BMI is associated with wealth index, marital status, sleep, smoking, alcohol use, and HIV status.[16,17] Socioeconomic status was significantly associated with BMI. The association between socioeconomic status and BMI showed difference only between black adult men and women.[18] Adults with moderate and low physical activity levels had increased likelihood of overweight/obesity. A study on BMI of men and women aged 25–64 years in Africa reported a high prevalence of underweight (low BMI) among Ethiopian women (42.7%) and men (36.7%).[11] A study conducted in Addis Ababa, unveiled a growing double burden of malnutrition due to continuously increasing overweight/obesity and continuously decreasing underweight.[19] Women of ages 45–65 years who have high income had the highest increase of overweight and obesity.[20] The prevalence of overweight/obesity increases and underweight decreases as we move from the lower to the higher wealth index brackets.[19] Trends in prevalence and related risk factors of overweight and obesity among women of reproductive age in Zimbabwe, 2005–2015, indicated that women of reproductive age had high and increasing risk of excess weight. The prevalence of obesity among women tripled particularly between 1975 and 2016.[21]

A study conducted on 36 developing countries states that the relationship between wealth index and overweight is different within and between countries.[22] Malnutrition, which includes underweight and/or overweight, is often used to refer to underweight in developing countries like Ethiopia.[23] But the prevalence of overweight is also increasing mainly in urban areas of developing countries. Because of rapid economic development and urbanization in low- and middle-income countries, the predominance prevalence of underweight has led a transition to a phenomenon known as the coexistence of dual burden of over- and underweight.[24]

Studies have found that when assessed by BMI, overweight and obesity are associated with the family socioeconomic status, a number of siblings, sedentary lifestyle, screen time (TV, computer, or video games), electronic equipment in the bedroom, total sedentary time, and moderate- to-vigorous physical activity.[25] Several studies about nutritional status (prevalence of underweight and overweight) in Ethiopia and Africa commonly concentrated on children aged under 5 years. But the prevalence of underweight and overweight are also very high, and limited attention is given.[23,26] Wealth index of households is a factor that shares the highest burden for young adults being underweight and overweight, among numerous factors in developing countries.[12,16,17] However, studies on wealth index and its association with BMI of men and women aged between 15 and 49 years remains unaccounted for as there is little study on the issue in Ethiopia. Thus, the aim of this study was to assess the association between BMI and wealth index, and other behavioral and sociodemographic characteristics of population in Ethiopia using 2016 demography and health survey data. As a result, the findings of this study will benefit policymakers at governmental and private levels to evaluate the impact of household wealth index, and other socioeconomic, demographic, behavioral, and biological factors on men and women BMI and to provide an accurate policy that enables to reduce the prevalence of non-communicable disease due to inappropriate nutritional status.

Methods and materials

Study design

A cross-sectional population-based study involving men and women of ages 15–49 years was conducted using the Ethiopian Demographic and Health Survey (EDHS) of 2016. EDHS provides estimates of population and health indicators for government stakeholders as input for health sector planning. For health-related problems that occur due to under and overweight, EDHS used tools such as BMI (adjusted for height) to evaluate societal health.[27] Figure 1 shows hypothesized risk factors that are socioeconomic (education, occupation, marital status, residence, wealth index, and region), demographic (age), biological (ethnicity, anemia, diarrhea, cough, fever, and sex), and behavioral (smoking, alcohol, chewing khat, religion) affecting BMI.[16]

Study population and sampling

The data for this study was obtained from the EDHS, 2016. The EDHS of 2016 was implemented by the Central Statistical Agency (CSA) of Ethiopia from 18 January to 27 June 2016. It is the fourth in a series of Demographic and Health Surveys conducted in Ethiopia. The main objective of the 2016 EDHS was to provide up-to-date information on healthcare indicators. The funding for the EDHS was provided by the government of Ethiopia, the United States Agency for International Development (USAID), the government of the Netherlands, the Global Fund, Irish Aid, the World Bank, the United Nations Population Fund (UNFPA), the United Nations Children's Fund (UNICEF), and United Nations Women.[27]

The sample for the 2016 EDHS was designed to provide estimates of population and health indicators for the country,

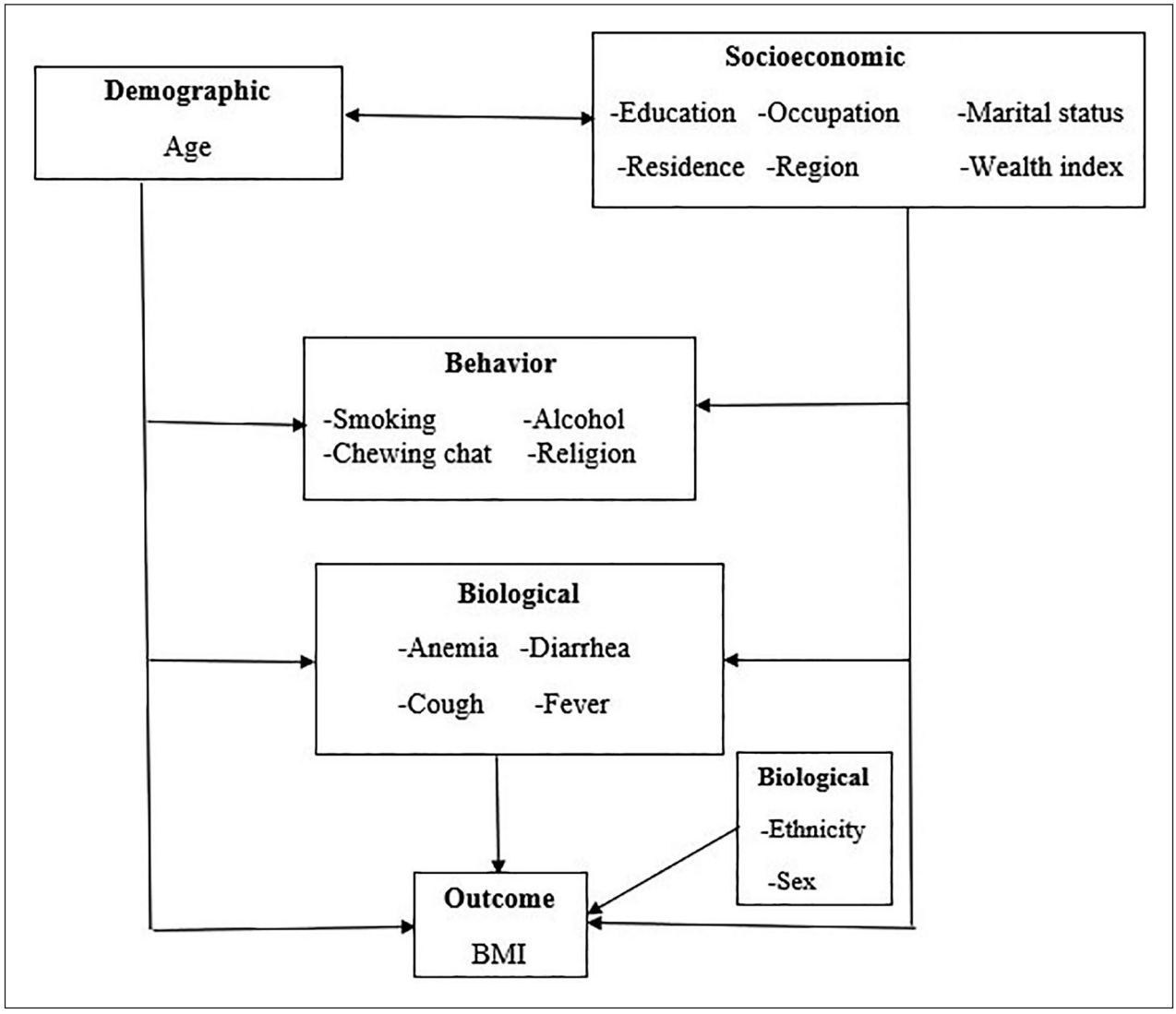

Figure 1. Hypothesized conceptual framework of risk factors of BMI.

the urban and rural areas separately, and each of the 11 regions (states) in Ethiopia, each region stratified into urban and rural. The sampling frame was the 2007 Population and Housing Census (PHC) of Ethiopia conducted by the CSA. The sample provides estimates in 11 regions for most health and demographic indicators. The 2016 EDHS sample involved two stages: first, selection of the enumeration areas, and second, selection of the households. Two-stage stratified random sampling involving proportional allocation was implemented on 10,245 valid individuals of ages 15–49 years. The data for this analysis considers the study design and the sample weight. The sample weight was given by EDHS and the authors taking into consideration the removal of redundant information from the same individual.

Inclusion and Exclusion Criteria: The authors selected participants from the EDHS dataset. Men and women of ages 15–49 years were selected and included in the study.

Variables in the study

The outcome variable of this study is BMI, calculated as the ratio of weight to the square of height for each individual unit. BMI was classified using the WHO classification, which has four groups: underweight, $BMI < 18.5$; normal, $18.5 \leqslant BMI < 25$; overweight for $25 \leqslant BMI < 30$; and obesity for $BMI \geqslant 30$.[21] However, for the purpose of better analysis and to address the problem of small sample size in each category, overweight and obesity were combined as one category in this study (see section "Results").

On the contrary, 17 independent variables partitioned into four main groups: socioeconomic status, biological, demographic, and behavioral factors were considered (see Table 1).

Studies in Mashinya et al.[17] and NCD Risk Factor Collaboration[9] reported that the BMI of peoples is associated with sex of the individuals. This result coincides with the

Table 1. Distribution of sociodemographic, behavioral, and biological characteristics by sex.

Characteristics		Men	Women
		n (%)	n (%)
Socioeconomic status	Residence		
	Urban	1269 (15.7)	588 (27.2)
	Rural	6811 (84.3)	577 (72.8)
	Marital status		
	Never married	21 (0.3)	37 (1.7)
	Married/cohabited	7913 (97.9)	1724 (79.6)
	Divorced/windowed/separated	146 (1.8)	404 (18.7)
	Occupation		
	Unemployment	4805(59.5)	1266(58.5)
	Merchant/government employee	912 (11.3)	321 (14.8)
	Farmer/laborer	2107 (26.1)	489 (22.6)
	Other personal work	240 (3.0)	82 (3.8)
	Education		
	No education	5228 (64.7)	1359 (62.8)
	Primary	2112 (26.1)	489 (22.6)
	Secondary	4489 (6.1)	205 (9.5)
	Higher	251 (3.1)	112 (5.2)
	Wealth index		
	Poorest	2838 (35.1)	1009 (46.6)
	Poorer	1498 (18.5)	242 (11.2)
	Middle	1233 (15.3)	191 (8.8)
	Richer	1091 (13.5)	179 (8.3)
	Richest	1420 (17.6)	544 (25.1)
	Region		
	Tigray	848 (10.5)	160 (7.4)
	Afar	663 (8.2)	361 (16.7)
	Amhara	882 (10.9)	361 (16.7)
	Oromia	1340 (16.6)	189 (8.7)
	Somalia	976 (12.1)	476 (22.0)
	Benishangul	684 (8.5)	139 (6.4)
	SNNPR	1079 (13.4)	169 (7.8)
	Gambela	435 (5.4)	255 (11.8)
	Harari	473 (5.9)	75 (3.5)
	Addis Ababa	314 (3.9)	129 (6.0)
	Dire Dawa	386 (4.8)	125 (5.8)
Behavior	Smoking		
	No	8003 (99.0)	2140 (98.8)
	Yes	77 (1.0)	25 (1.2)
	Alcohol		
	No	5821 (72.0)	1739 (80.3)
	Yes	2259 (28.0)	426 (19.7)
	Chewing khat		
	No	7155 (88.6)	1972 (91.1)
	Yes	925 (11.4)	193 (8.9)
	Religion		
	Orthodox	2510 (31.1)	466 (21.5)
	Muslim	3936 (48.7)	1270 (58.7)
	Protestant and others	1634 (20.2)	429 (19.8)
Demographic	Age in years		
	15–19	264 (3.3)	116 (5.4)
	20–24	1666 (20.6)	431 (19.9)
	25–29	2475 (30.6)	584 (27.0)

(Continued)

Table 1. (Continued)

Characteristics		Men	Women
		n (%)	n (%)
	30–34	1775 (22.0)	496 (22.9)
	35–39	1269 (15.7)	349 (16.1)
	40–44	482 (6.0)	143 (6.6)
	45–49	149 (1.8)	46 (2.1)
Biological	Ethnicity	1317 (16.3)	220 (10.2)
	Amhara	2141 (26.3)	347 (16.0)
	Oromo	886 (11.0)	189 (8.7)
	Tigrie	602 (7.5)	335 (15.5)
	Afar	969 (12.0)	445 (22.4)
	Somalie	192 (2.4)	55 (2.5)
	Guragie	165 (2.0)	120 (5.5)
	Nuwer	168 (2.1)	28 (1.3)
	Welaita	1162 (14.4)	298 (13.8)
	Other souths	478 (5.9)	88 (4.1)
	Others		
	Anemia		
	No	5191 (65.2)	1283 (59.3)
	Yes	2765 (34.8)	882 (40.7)
	Diarrhea		
	No	6720 (88.2)	1850 (85.5)
	Yes	903 (11.8)	315 (14.5)
	Cough		
	No	6335 (82.7)	1746 (80.6)
	Yes	1324 (17.3)	310 (19.4)
	Fever		
	No	6547 (86.0)	1765 (81.5)
	Yes	1070 (14.0)	400 (18.5)
	Sex	8080 (78.9)	2165 (21.1)
Outcome	BMI		
	Underweight	1925 (23.8)	547 (25.3)
	Normal weight	5455 (67.5)	1358 (62.7)
	Overweight	537 (6.6)	198 (9.1)
	Obesity	163 (2.0)	62 (2.9)

SNNPR: Southern Nations, Nationalities, and People's region; BMI: body mass index.
n is frequency and % is percent or proportion.

preliminary analysis result of this study ($\chi^2 = 28.87$ with $p = 0.000$).

As a result, throughout this article, predominantly gender-specific analysis was carried out.

Statistical methods

Logistic regression. Logistic regression is a statistical model used to detect the association of a categorical outcome variable and a set of factors.[28] When the categorical values of the outcome variable are enabled to be placed in order, ordinal logistic regression is used. As the outcome variable, BMI, considered in this study contains ordinal categorical values such as underweight ($BMI < 18.5$), normal weight ($18.5 \leqslant BMI < 25$), overweight ($25 \leqslant BMI < 30$), and obesity ($BMI \geqslant 30$), ordinal logistic regression model was used to analyze the data. For the sake of better analysis and to have adequate sample size in each category of BMI, the categories "overweight" and "obesity" were combined together and considered as a third category. Hence, the outcome variable, BMI, considered in this analysis contains three ordinal categories: "underweight," "normal weight," and "overweight and obesity."

Assuming the outcome variable denoted by Y that consists j categories to have natural order and $X = \{x_1, x_2, \ldots, x_p\}$ factors, the probability that an individual belongs to the jth category of outcome variable given all possible factors X is given

by $P(Y=j|X)=\pi_j(x)$. Fitting ordinal logistic regression model entails to estimate the chance of an individual to fall at category j and below, and/or greater given that of certain characteristics. As a result, ordinal logistic regression model is also called cumulative logit model. The cumulative probability for Y that Y falls at or below a particular outcome category j is

$$P(Y \le j \mid \mathbf{X}) = \pi_1(x) + \cdots + \pi_j(x)$$

And then, the cumulative logit model is given by[28]

$$\text{logit}\left(P\left[Y_{ik} \le j|\mathbf{X}\right]\right) = \log\left(\frac{P\left[Y \le j|\mathbf{X}\right]}{1-P\left[Y \le j|\mathbf{X}\right]}\right) = \alpha_j + X\beta, \quad j=1,2,\ldots J \tag{1}$$

where α_j is the intercept (can differ for each j), $\mathbf{X}$ is matrix of all possible factors and β its corresponding effect. The adjusted odds ratio (aOR) with 95% confidence interval (95% CI) were calculated using SAS software version 9.4 and used for interpretation.

Goodness of fit test. The proportional odds assumption that tests whether all the logit surfaces are parallel, was checked.[28] A non-significant test is an evidence that the logit surfaces are parallel and hence the odds ratio can be interpreted as constant across all possible BMI groups, the outcome variable. From the score test of proportional odds assumption, it was found that the chi-square statistics was $\chi^2=2.45$ and p-value ($0.067 \geqslant 0.05$) indicating that the proportional odds assumption holds. For the proposed model to be a good fit of the data, checking the multicollinearity test is also a crucial issue that needs to be addressed[28] because, logistic regression model assumes that independent variables in the model are independent. One of the main methods to handle multicollinearity problem is variable selection especially when we have numerous variables included in the model, which have been done separately for men and women before fitting the model in the section "Model fitting."

Results

Of the total number of 10,245 subjects, 8080 were men and 2165 were women. The prevalence of underweight, overweight, and obesity among men were 23.8%, 6.6%, and 2.1%, respectively, and lower than women, which equals to 25.3% underweight, 9.1% overweight, and 2.9% obesity. Thus, of the total of 10,245 subjects in the study, 3432 ($\approx$ 33.5%; regardless of sex) had underweight, overweight, or obesity. In the case of both men and women, the highest population proportion, 35.1% and 46.6%, respectively, belong to the poorest wealth index. Most of the population were Muslims for both sexes (men 48.7% and women 58.7%) and the lowest were protestants and others (men 20.2% and women 19.8%). The age of highest population number (men 30.6% and women 27.6%) was 25–29 years, while that of lowest were aged 45–49 (men 1.8% and women 2.1%), see Table 1.

The highest number of men and women were from Oromia (16.6%) and Somalia (22.0%) region, while the lowest men were from Dire Dawa and women from Harrari. The unemployed men population (59.5%) nearly equals to the unemployed women population (58.5%), which indicates that of the total population in the study, nearly 40% were employed. Most of them from both sexes (men 26.1% and women 22.6%) were farmers or laborers. In behavioral risk factors, cigarette smokers were small (men 1.0% and women 1.2%). The proportion of subjects consuming alcohol was 28% for men and 19.7% for women. Similarly, the proportion of khat-chewing subjects were 11.4% for men and 8.9% for women. Anemia is reported to be lower among men than among women (34.0% versus 38.6%), while there was no visible difference in fever infection (12.9% versus 12.8%) between men and women, see Table 1. Similarly, the proportion of men infected with diarrhea and cough (10.8%, 15.6%), respectively, was close in proportion to women infected with diarrhea and cough (8.9% and 13.7%). In terms of places of residence, most of the subjects included in this study were from rural area (men 84.3% and women 72.8%). In case of access to education, we found that more than 60% of the population have no formal education attainment (men 64.7% and women 62.8%), which did not have even primary education, or they were illiterate; while only 3.1% of men and 5.2% of women had higher education. With respect to access to education, we found that more than 60% did not have education (men 64.7% and women 62.8%), many have neither primary education or are illiterate, while only 3.1% of men and 5.2% of women have higher education. Figure 2 shows the number of people in each wealth index category per BMI group. It suggests that the richest subjects were more likely to have overweight and obesity relative to people whose wealth index belongs from poorest, poorer, middle, and richer category. In contrast, the poorest and poorer peoples are more likely to have underweight. The likelihood of the richest people being included in the underweight BMI group was the lowest.

The bivariate analysis that depicts the presence of association between characteristics (independent variables) with BMI was presented among men and women in Tables 2 and 3, respectively. Both tables revealed the relationship between independent variables and the outcome variable (BMI: leveled as underweight, normal weight, and overweight and obesity). From Table 2, we can see that the only variables not significantly associated with BMI were diarrhea ($p=0.567$) and cough ($p=0.072$) meaning that the patterns of BMI across men who were infected by diarrhea and cough were the same, while the remaining variables had significant

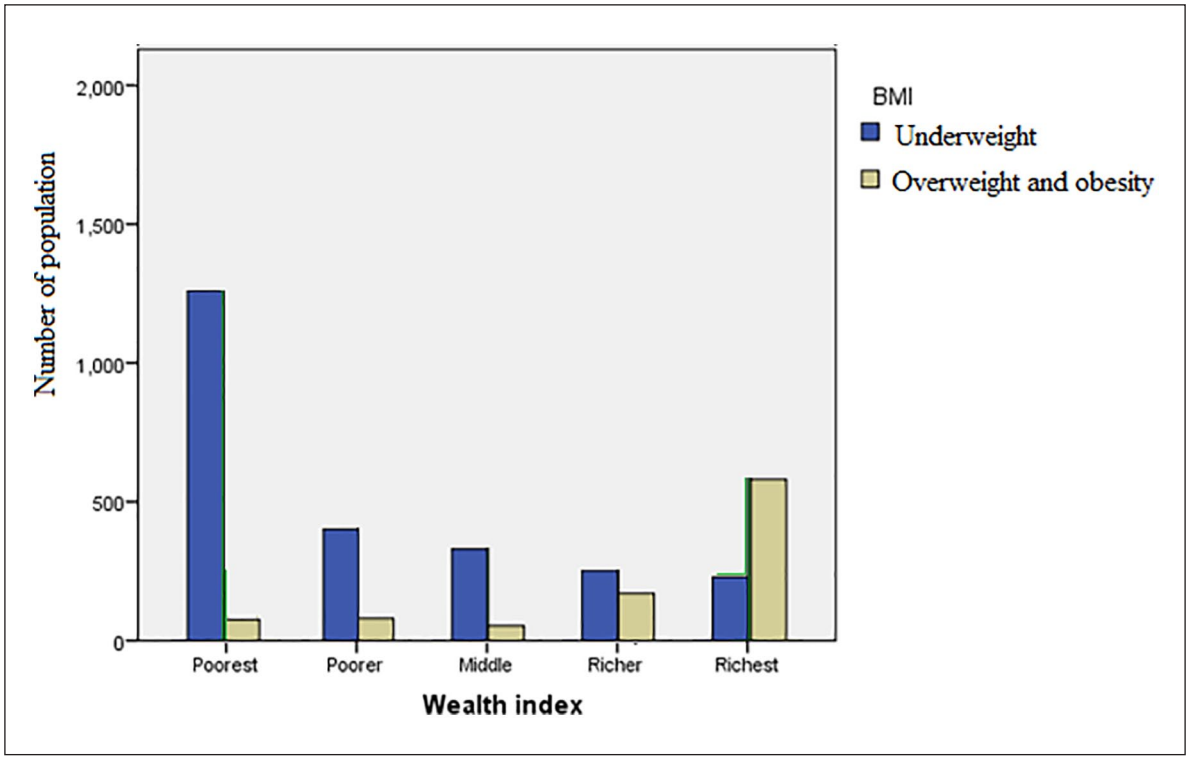

Figure 2. Bar plot representing wealth index.

association ($p \leqslant 0.05$) with BMI. The proportion of men from urban areas increased when BMI category raised from underweight (8.3%) to overweight and obesity (56.0%). In contrast, the proportion of men from rural areas decreased with increase in the level of BMI category raised from underweight (91.7%) to overweight and obesity (44.0%). In parallel, the proportion of merchant and government employee men increased when the level of BMI increased from underweight (7.2%) to overweight and obesity (25.7%). Most of the unemployed men (65.6%) were underweight. When the wealth index of men improved from poorest to richest, the likelihood of men being in the underweight BMI decreased from 48.1% to 16.7% indicating that men who belong to richest category were less likely to be underweight, though they are more likely to be overweight and obese (60.7%). BMI also has variation among the different regions. The highest proportion of men with overweight and obesity were from Somalia (20.6%) and Addis Ababa (20.1%). Most of the normal-weight men were from Oromia and most of the overweight and obesity men were from Somalia. Welaita and Nuwer had low proportion of men (less than 2%) with overweight and obesity. Fifty-two percent of men with overweight and obesity were Muslim. Men who had anemia (39.5%) were inclined to be underweight.

The associations of different characteristics with BMI for women were presented in Table 3. The bivariate analysis of women that manifest the association between women characteristics and BMI suggests that residence, occupation, level of education, wealth index, region, alcohol intake, khat consumption, and age were the only variables independently associated with BMI (p-value < 0.05).

The proportion of women from urban areas increased from 14.6% to 61.2% when the BMI raised from underweight to overweight and obesity. The reverse is true for rural women. Like the case for men, the proportion of women who are merchant and government employee increased when BMI increased from underweight (9.7%) to overweight and obesity (30.0%) while the proportion of farmer and laborer women decreased when BMI increased from underweight (26.2%) to overweight and obesity (11.5%).

Women who were underweight (68.6%), normal weight (63.9%), overweight and obesity (44.6%) in BMI did not attend their education. Women in the poorest wealth index (61.1%) were more likely to be underweight, while those who belong to the richest in wealth index were less likely (9.9%) to be underweight and more likely (60.0%) to be overweight and obese. Like the case in men, for most of the women, the highest categories of BMI were from Somalia (32.7%) and Addis Ababa (18.8%). On the contrary, most women from Afar (25.6%) and Gambela (22.1%) were in the underweight BMI group. The highest alcohol consumer women (24.6%) belong to the overweight and obesity BMI,

Table 2. Bivariate analysis of factors that associated with BMI among men in Ethiopia.

Characteristics	BMI			p-value
	Underweight, n (%)	Normal weight, n (%)	Overweight and obesity, n (%)	
Residence				
Urban	159 (8.3)	718 (13.2)	392 (56.0)	0.000
Rural	176 (91.7)	4737 (86.8)	308 (44.0)	
Marital status				
Never married	3 (0.2)	14 (0.3)	4 (0.6)	
Married/cohabited	1882 (97.8)	5351 (98.1)	680 (97.1)	0.005
Divorced/widowed/separated	40 (2.1)	90 (1.6)	16 (2.3)	
Occupation				
Unemployment	1240 (64.6)	3145 (57.8)	420 (60.0)	
Merchant and government employee	139 (7.2)	593 (10.9)	180 (25.7)	0.001
Farmer and laborer	483 (25.2)	1554 (28.5)	70 (10.0)	
Other personal work	58 (3.0)	153 (2.8)	30 (4.3)	
Education				
No education	1336 (69.4)	3591 (65.8)	301 (43.0)	
Primary	452 (23.5)	1466 (26.9)	194 (27.7)	0.001
Secondary	103 (5.4)	276 (5.1)	110 (15.7)	
Higher	34 (1.8)	122 (2.2)	95 (13.6)	
Wealth index				
Poorest	926 (48.1)	1795 (32.9)	117 (16.7)	
Poorer	349 (18.1)	1087 (19.9)	62 (8.9)	0.000
Middle	277 (14.4)	916 (16.8)	40 (5.7)	
Richer	198 (10.3)	837 (15.3)	56 (8.0)	
Richest	175 (9.1)	820 (15.0)	425 (60.7)	
Region				
Tigray	261 (13.6)	553 (10.1)	34 (4.9)	
Afar	266 (13.8)	365 (6.7)	32 (4.6)	0.001
Amhara	179 (9.3)	676 (12.4)	27 (3.9)	
Oromia	287 (14.9)	988 (18.1)	65 (9.3)	
Somalia	267 (13.9)	565 (10.4)	144 (20.6)	
Benishangul	132 (6.9)	517 (9.5)	35 (5.0)	
SNNPR	137 (7.1)	873 (16.0)	69 (9.9)	
Gambela	180 (9.4)	233 (4.3)	22 (3.1)	
Harari	100 (5.2)	296 (5.4)	77 (11.0)	
Addis Ababa	17 (0.9)	156 (2.9)	141 (20.1)	
Dire Dawa	99 (5.1)	233 (4.3)	54 (7.7)	
Smoking				
No	1896 (98.5)	5410 (99.2)	697 (99.6)	0.031
Yes	29 (1.5)	45 (0.8)	3 (0.4)	
Alcohol				
No	1437 (74.6)	3880 (71.1)	504 (72.0)	0.014
Yes	488 (25.4)	1575 (28.9)	196 (28.0)	
Chewing khat				
No	1737 (90.2)	4814 (88.2)	604 (86.3)	0.024
Yes	188 (9.8)	641 (11.81)	96 (13.7)	
Religion				
Orthodox	533 (27.7)	1727 (31.7)	250 (35.7)	
Muslim	1035 (53.8)	2537 (46.5)	364 (52.0)	0.026
Protestant and others	357 (18.5)	1191 (21.8)	86 (12.3)	
Age in years				
15–19	78 (4.1)	181 (3.3)	5 (0.7)	
20–24	483 (25.1)	1090 (20.0)	93 (13.3)	0.001
25–29	538 (27.9)	1711 (31.4)	226 (32.3)	
30–34	373 (19.4)	1202 (22.0)	200 (28.6)	

(Continued)

Table 2. (Continued)

Characteristics	BMI			p-value
	Underweight, n (%)	Normal weight, n (%)	Overweight and obesity, n (%)	
35–39	300 (15.6)	845 (15.5)	124 (17.7)	
40–44	102 (5.3)	334 (6.1)	46 (6.6)	
45–49	51 (2.6)	92 (1.7)	6 (0.9)	
Anemia				
No	1147 (60.5)	3546 (66.1)	498 (71.1)	0.001
Yes	748 (39.5)	1815 (33.9)	202 (28.9)	
Diarrhea				
No	1575 (88.3)	4536 (88.4)	609 (87.0)	0.567
Yes	209 (11.7)	597 (11.6)	91 (13.0)	
Cough				
No	1479 (82.9)	4268 (83.1)	588 (84.0)	0.072
Yes	305 (17.1)	865 (16.9)	112 (16.0)	
Fever				
No	1515 (84.9)	4416 (86.0)	616 (88.0)	0.046
Yes	269 (15.1)	717 (14.0)	84 (12.0)	
Ethnicity				
Amhara	220 (11.4)	952 (17.5)	145 (20.7)	
Oromo	469 (24.4)	1504 (27.6)	168 (24.0)	0.014
Tigrie	267 (13.9)	566 (10.4)	53 (7.6)	
Afar	256 (13.3)	326 (6.0)	20 (2.9)	
Somalie	269 (14.0)	549 (10.1)	151 (21.6)	
Guragie	33 (1.7)	115 (2.1)	44 (6.3)	
Nuwer	98 (5.1)	64 (1.2)	3 (0.4)	
Welaita	15 (0.8)	141 (2.6)	12 (1.7)	
Other souths	229 (11.9)	868 (15.9)	60 (8.6)	
Others	69 (3.6)	370 (6.8)	39 (5.6)	

BMI: body mass index; SNNPR: Southern Nations, Nationalities, and People's region.
n is frequency and % is percent or proportion.

while the lowest (14.8%) were of the underweight BMI. Women who consume khat were 6.4%, 9.1%, and 13.1% from underweight, normal weight, and overweight and obesity BMI group, respectively. Of the overweight and obesity women, the highest proportion (60.0%) were Muslim. The lowest proportion of women (1.5%) aged 45–49 years were overweight and obese, while those between ages 30 and 34 years had the highest overweight and obesity (32.3%). There were more women with anemia complications in the underweight BMI group (43.6%) than women with anemia in the normal weight (38.8%), and overweight and obesity (36.5%). Women from Nuwer ethnicity were less likely to be overweight and obese. This might be because of their day-to-day activity, which involves physical movements such as hunting animals, collecting fruits, and farming lands.

The bivariate analysis using chi-square test for men (Table 2) and women (Table 3) tests the existence of differences of men and women characteristics with BMI, respectively, but provides little information on trends in the order of groups. Trend test provides additional insight into the pattern of the relationship between variables and uses to examine whether categorical variables increase or decrease across ordered groups.[29] Table 4 displays the trends test for continuous variables after grouping into more than three categories (education level, wealth index, and age) over ordinal values of BMI (underweight, normal weight, and overweight and obesity) using Cochran–Mantel–Haenszel (CMH) trend test. The test tells us there is an overall significant association/trend or pattern ($p \leqslant 0.0001$) between independent variables (educational level, wealth index, and age) and response variable (BMI).

Model fitting

A total of 16 potential factors/independent variables/characteristics were considered in this study. The aim was to determine the presence of significant association between the levels of BMI and variables in socioeconomic status, biological, behavioral, and demographical status. Logistic regression assumes independence among independent variables, that is, no multicollinearity. Therefore, a test of correlation among independent variables (multicollinearity test)

Table 3. Bivariate analysis of factors that associated with BMI among women in Ethiopia; underweight, normal weight, overweight and obesity.

Characteristics	BMI			p-value
	Underweight	Normal weight	Overweight and obesity	
	n (%)	n (%)	n (%)	
Residence				
Urban	80 (14.6)	349 (25.7)	159 (61.2)	0.000
Rural	467 (85.4)	1009 (74.3)	101 (38.8)	
Marital status				
Never married	7 (1.3)	27 (2.0)	3 (1.2)	0.600
Married/cohabited	426 (77.9)	1088 (80.1)	210 (80.8)	
Divorced/widowed/separated	114 (20.8)	243 (179)	47 (18.1)	
Occupation				
Unemployment	340 (62.4)	786 (58.1)	140 (53.8)	0.001
Merchant and government employee	53 (9.7)	190 (14.0)	78 (30.0)	
Farmer and laborer	143 (26.2)	316 (23.4)	30 (11.5)	
Other personal work	9 (1.7)	61 (4.5)	12 (4.6)	
Education				
No education	375 (68.6)	868 (63.9)	116 (44.6)	0.000
Primary	117 (21.4)	306 (22.5)	66 (25.4)	
Secondary	44 (8.0)	121 (8.9)	40 (15.4)	
Higher	11 (2.0)	63 (4.6)	38 (14.6)	
Wealth index				0.000
Poorest	334 (61.1)	622 (45.8)	53 (20.4)	
Poorer	52 (9.5)	172 (12.7)	18 (6.9)	
Middle	53 (9.7)	124 (9.1)	14 (5.4)	
Richer	54 (9.9)	106 (7.8)	19 (7.3)	
Richest	54 (9.9)	334 (24.6)	156 (60.0)	
Region				
Tigray	45 (8.2)	107 (7.9)	8 (3.1)	
Afar	140 (25.6)	205 (15.1)	16 (6.2)	0.005
Amhara	15 (2.7)	64 (4.7)	8 (3.1)	
Oromia	34 (6.2)	141 (10.4)	14 (5.4)	
Somalia	111 (20.3)	280 (20.6)	85 (32.7)	
Benishangul	21 (3.8)	114 (8.4)	4 (1.5)	
SNNPR	24 (4.4)	133 (9.8)	12 (4.6)	
Gambela	121 (22.1)	123 (9.1)	11 (4.2)	
Harari	11 (2.0)	46 (3.4)	18 (7.1)	
Addis Ababa	4 (0.7)	76 (5.6)	49 (18.8)	
Dire Dawa	21 (3.8)	69 (5.1)	35 (13.5)	
Smoking				
No	538 (98.4)	1343 (98.9)	259 (99.6)	0.395
Yes	9 (1.6)	15 (1.1)	1 (0.4)	
Alcohol				
No	466 (85.2)	1077 (79.3)	196 (75.4)	0.004
Yes	81 (14.8)	281 (20.7)	64 (24.6)	
Chewing khat				
No	512 (93.6)	1234 (90.9)	226 (86.9)	0.020
Yes	35 (6.4)	124 (9.1)	34 (13.1)	
Religion				
Orthodox	86 (15.7)	306 (22.5)	74 (28.5)	
Muslim	317 (58.0)	797 (58.7)	156 (60.0)	0.028
Protestant and others	144 (26.3)	255 (18.8)	30 (11.5)	

(Continued)

Table 3. (Continued)

Characteristics	BMI			p-value
	Underweight	Normal weight	Overweight and obesity	
	n (%)	n (%)	n (%)	
Age in years				
15–19	45 (8.2)	64 (4.7)	7 (2.7)	0.001
20–24	118 (21.6)	298 (21.9)	15 (5.8)	
25–29	136 (24.9)	383 (28.2)	65 (25.0)	
30–34	131 (23.9)	281 (20.7)	84 (32.3)	
35–39	70 (12.8)	224 (16.5)	55 (21.2)	
40–44	34 (6.2)	79 (5.8)	30 (11.5)	
45–49	13 (2.4)	29 (2.1)	4 (1.5)	
Anemia				
No	302 (56.4)	816 (61.2)	165 (63.5)	0.063
Yes	233 (43.6)	518 (38.8)	95 (36.5)	
Diarrhea				
No	472 (91.8)	1143 (89.4)	235 (90.4)	0.074
Yes	42 (8.2)	136 (10.6)	25 (9.6)	
Cough				
No	443 (86.2)	1084 (84.8)	219 (84.2)	0.328
Yes	71 (13.8)	195 (15.2)	41 (15.8)	
Fever				
No	447 (87.0)	1091 (85.3)	227 (87.3)	0.615
Yes	67 (13.0)	188 (14.7)	33 (12.7)	
Ethnicity				
Amhara	27 (4.9)	147 (10.8)	46 (17.7)	
Oromo	60 (11.0)	241 (17.7)	46 (17.7)	0.030
Tigrie	50 (9.1)	116 (8.5)	23 (8.8)	
Afar	134 (24.5)	191 (14.1)	10 (3.8)	
Somalie	109 (19.9)	282 (20.8)	94 (36.2)	
Guragie	6 (1.1)	33 (2.4)	16 (6.2)	
Nuwer	61 (11.2)	56 (4.1)	3 (1.2)	
Welaita	3 (0.5)	20 (1.5)	5 (1.9)	
Other souths	42 (7.6)	203 (14.9)	10 (3.8)	
Others	13 (2.4)	69 (5.1)	6 (2.3)	

BMI: body mass index; SNNPR: Southern Nations, Nationalities, and People's region.
n is frequency and % is percent or proportion.

Table 4. Cochran–Mantel–Haenszel (CMH) trend test for continuous variables that divided into more than three categories.

	Men		Women	
	CMH test statistic	p-value	CMH test statistic	p-value
Education level	469.37	0.0001	90.58	⩽0.0001
Wealth index	1220.00	0.0001	270.91	⩽0.0001
Age	109.34	0.0001	85.06	⩽0.0001

must be performed before using any independent variable in the modeling process. To address this, first variable selection was done[19] and then model is selected using model comparison tools such as Akaike information criterion (AIC) and/or Bayesian information criterion (BIC).[28] A model having less AIC and BIC is preferred.[28] Variable selection was made using stepwise selection by 20% entry and 25% stay significance level. A model fitted for men by including all variables had AIC = 2982 and BIC = 3264, while after variable selection is carried out and a model is fitted in Table 4, AIC and BIC become 637 and 849, respectively. This indicates that a model containing only selected variables is good fit for the data. A similar procedure was adopted for a model fitted for women in Table 5. The model containing all variables had AIC = 3893 and BIC = 4229, which reduced to AIC = 1573 and BIC = 1759 for model containing only selected variables. Having the variable selection done, possible interaction effects between selected variables were also checked and incorporated in the model, see in Figures 1 and 2 for men and women, respectively. The variables included in the model were age from demographic; region, wealth index, occupation, and education from socioeconomic status; and smoking from the biological indicators.

Results in Table 5 revealed that wealth index is the only important socioeconomic determinants ($p = 0.0220$) of men's BMI but it varied according to region (interaction effect; $p \leqslant 0.0001$), meaning that the effect of wealth index is different for peoples from different regions.

Lower BMI is associated with the lower income categories in men. The poorest men had higher odds of being underweight (aOR = 2.395%; 95% CI = 2.020–3.544) compared to the richest men. This means men who belong to poorest wealth index were more likely to be underweight as compared to men whose wealth index status belong to the richest. But caution needs to be made while interpreting wealth index since there is interaction with region. For instance, most people from SNNPR usually consume fruits and vegetables, which make them more likely to have normal weight. On the contrary, people from Afar and Tigray who are mostly confronted with dry weather and less productivity tend to have higher tendency of being underweight regardless of how rich they are. Men's age was significantly associated with BMI though it varies depending on their place of residence (urban, rural) as well as their region. It can also be depicted from interaction plot in Figure 3(b). Men from rural area are substance individual-level farmers and labor workers and they are less likely to have overweight and obesity, which is also different by age. The ethnicity of men had also significant association ($p \leqslant 0.021$) with BMI. Men from Amhara, Afar, Gurage, Nuwer, and other souths had slightly higher odds (aOR = 1.088, 2.055, 1.799, 5.966, and 1.251, respectively) of being underweight as compared to Welaita men. Merchants and government employees had lower odds (aOR = 0.744; 95% CI = 0.588–0.899) compared to farmers and laborers, which indicates that men merchant and government employees men are less likely to be underweight compared to men who were working as farmer and laborer. Nonsmoker men were less likely to fall in the lower BMI categories as compared to smoker men while khat-chewing men fall in the lower categories of BMI that was 1.2 times those of non-users.

We also observed that fever, anemia, and smoking were significant biological determinants ($p \leqslant 0.05$) of BMI. The odds of men who did not have fever (aOR = 0.851; 95% CI = 0.730–0.971), anemia (aOR = 0.819; 95% CI = 0.785–0.929), and smoking cigarette (aOR = 0.414; 95% CI = 0.234–0.889) were higher than the odds of men who have fever, anemia, and smoking cigarette, respectively.

Results in Table 6 revealed that women's age is a significant demographic determinant of BMI though its effect depended on women's wealth index (interaction effect, $p \leqslant 0.0001$), see Figure 4. Most women are young, of ages 15–19 and/or 20–24 years, and their likelihood of being overweight and obese is less even if they have richer and/or richest wealth index. Women of ages 15–19 and 20–24 years had higher odds (aOR = 2.210; 95% CI = 1.045–4.339 and aOR = 1.612; 95% CI = 0.843–3.052, respectively) and tend to be underweight compared to women of ages 45–49 years given that women have richest wealth index. Keeping other factors constant, like that of men in Table 4, compared to richest women, the odds of poorest women was higher (aOR = 3.294; 95% CI = 2.415–4.516) making them likely to be underweight compared to richest women with ages 45–49 years. It is also found that region, education, and occupation were significant socioeconomic determinants for the BMI of women. Compared to women from Harari, women from Tigray had higher odds (aOR = 2.269; 95% CI = 1.249–4.114) of being underweight meaning that women from Tigray were more likely to be underweight. In contrast, women from Somalia were less likely to be underweight compared to women from Harari. Non-educated women were more than two times likely to be underweight (aOR = 2.029; 95% CI = 1.262–3.262) compared to women who had higher education. Relative to women who were working as farmers and/or laborers, women who were merchants and/or government employees were less likely to be underweight.

Discussion

In this study, attempt was made to demonstrate the association of BMI with wealth index and other sociodemographic and behavioral factors among women and men aged 15–49 years in Ethiopia. High prevalence of abnormal BMI was exhibited in women than men, which shows the dual-burden coexistence of under- and overweight in the Ethiopian population. This evidence supports other findings, which reported that the burden of excess weight or BMI is considerably higher among women than men.[11,17] A study in Kenya also indicates that a high proportion of women are overweight or obese.[30]

Table 5. Logistic regression model fitting for multivariate association between demographic, socioeconomic, behavioral risk factors, and BMI among men of ages (15–49 years), in Ethiopia.

Effect		aOR (95% CI)	p-value
Wealth index	Poorest	2.395 (2.020, 3.544)***	0.0220
	Poorer	2.316 (1.825, 3.131)**	
	Middle	2.422 (1.890, 3.134)**	
	Richer	2.172 (1.600, 2.687)*	
	Richest (ref.)		
Region	Tigray	1.731 (0.931, 3.422)	0.3012
	Afar	1.337 (0.755, 2.342)	
	Amhara	1.417 (1.007, 2.034)*	
	Oromia	1.044 (0.803, 1.328)	
	Somalia	0.889 (0.524, 1.509)	
	Benishangul	1.081 (0.745, 1.577)	
	SNNPR	0.921 (0.733, 1.279)	
	Gambela	1.344 (0.875, 2.056)	
	Addis Ababa	0.536 (0.371, 0.702)***	
	Dire Dawa	1.252 (0.950, 1.801)	
	Harari (ref.)		
Age in years	15–19	1.145 (0.821, 1.791)	<0.0001
	20–24	1.061 (0.920, 1.561)	
	25–29	0.660 (0.470, 0.952)**	
	30–34	0.599 (0.411, 0.879)***	
	35–39	0.615 (0.414, 0.898)***	
	40–44	0.575 (0.423, 0.869)**	
	45–49 (ref.)		
Ethnicity	Amhara	1.188 (1.088, 1.671)***	
	Oromo	1.447 (0.947, 2.231)	
	Tigrie	1.453 (0.736, 2.867)	
	Afar	2.055 (1.070, 3.984)*	
	Somalie	1.256 (0.712, 2.532)	
	Guragie	1.799 (1.200, 2.976)*	
	Sidama	1.472 (0.908, 2.384)	
	Nuwer	5.966 (3.210, 10.898)***	
	Other souths	1.251 (1.011, 2.602)*	
	Other	0.960 (0.641, 1.478)***	
	Welaita (ref.)		
Occupation	Unemployment	0.965 (0.821, 1.125)	0.0005
	Merchant and government employee	0.744 (0.588, 0.899)***	
	Others personal work	1.439 (1.052, 1.953)***	
	Farmer and laborer (ref.)		
Fever	No	0.851 (0.730, 0.971)*	0.021
	Yes (ref.)		
Anemia	No	0.819 (0.785, 0.929)*	0.0236
	Yes (ref.)		
Smoking	No	0.414 (0.145, 0.889)*	0.0228
	Yes (ref.)		
Chewing khat	No	1.162 (0.974, 1.382)	0.0625
	Yes (ref.)		
Education level	No education	1.276 (0.928, 1.766)*	0.7012
	Primary	1.131 (0.821, 1.532)	
	Secondary higher (ref.)	1.024 (0.729, 1.442)	
Interaction			
	Wealth × Region	1.846	<0.0001
	Age × Region	1.1378	<0.0001
	Age × Residence	1.0937	<0.0001

aOR: adjusted odds ratio; CI: confidence interval; SNNPR: Southern Nations, Nationalities, and People's region.
***$p \leqslant 0.001$, **$p \leqslant 0.01$, *$p \leqslant 0.05$.

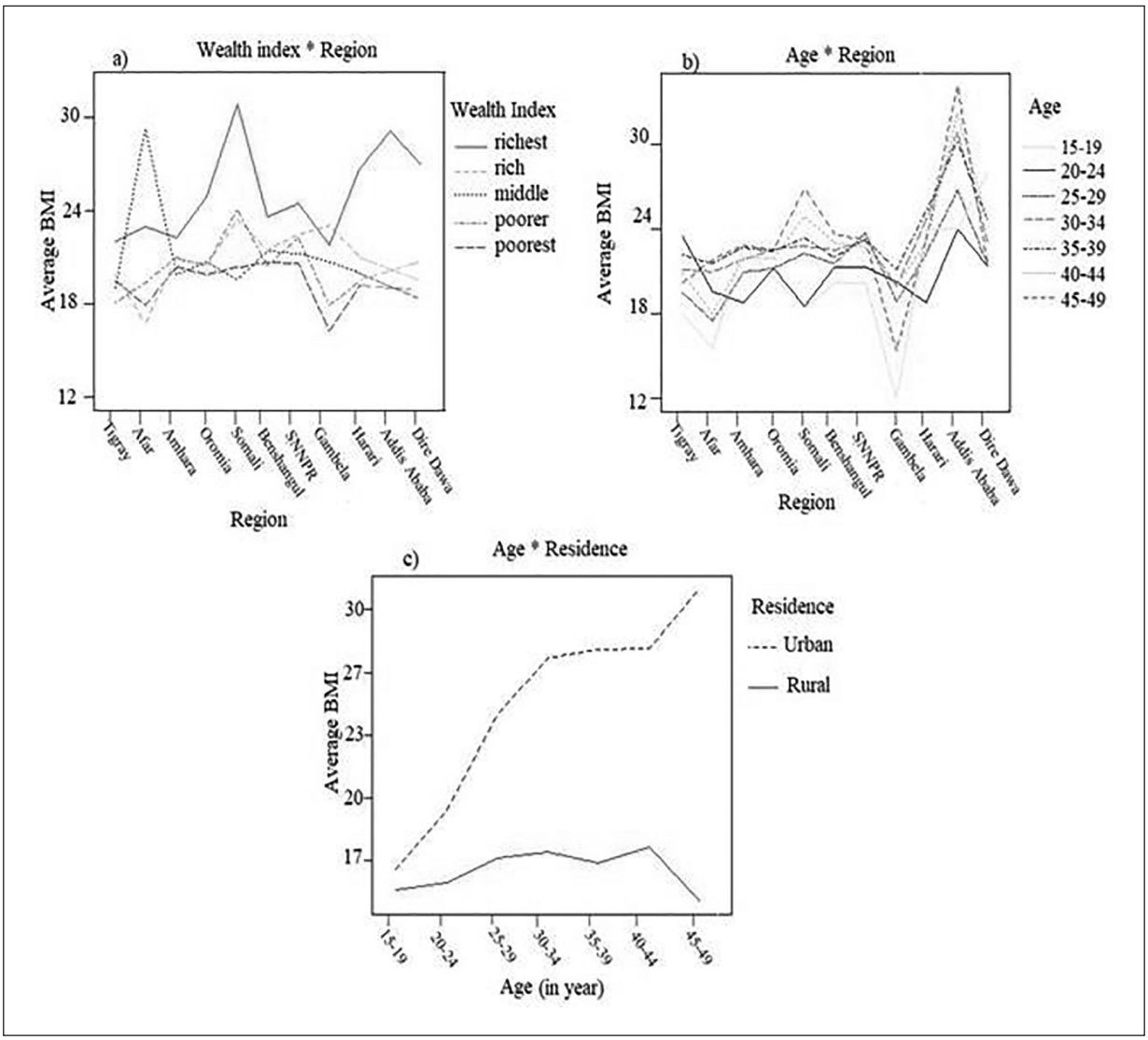

Figure 3. Interaction plot between (a) wealth index and region, (b) age and region, and (c) age and residence characteristics of men.

The highest proportion of the population among men and women had the poorest wealth index. When the wealth index of men increases from poorest to richest, the likelihood of being underweight decreases. Wealth index was the only important socioeconomic determinant of men's BMI and this is consistent with studies,[17] which stated that a higher level of wealth index is associated with high BMI among men and women. However, in our study, the association of wealth index with BMI varied according to the region men are living in. The proportion of men from urban area increased with increase in BMI from underweight to overweight and obesity. In contrast to this, the proportion of men from rural areas decreased with increases in BMI from underweight to overweight and obesity. This may be because in the Ethiopian context people living in rural areas are individual-level farmers, which entails hard physical work, while those in urban lead a sedentary lifestyle. This is consistent with the findings and suggests that BMI is rising globally with a faster increase in urban areas in low- and middle-income countries.[8,17] This was also in line with a study conducted on Kenyan women, which states that residing in an urban area and having a high level of education or wealth are significant predictors of increasing the odds of being overweight or obese.[30]

Age of men had also a significant association with BMI and depended much on their place of residence (urban, rural) as well as region.[17,22,31] This may be because of the variations in weather conditions, attitudes and beliefs, and lifestyle differences among men living in different places of residence and regions, which may affect the BMI among different age groups. Considering the occupation of men, merchants and government employees had lower odds of being underweight as compared to farmer and laborer men indicating that merchant and government employees were

Table 6. Multivariate association between demographic, socioeconomic, behavioral risk factors, and BMI among women of ages (15–49 years), in Ethiopia.

Effect		aOR (95% CI)	p-value
Education	No education	2.029 (1.262, 3.262)**	0.0124
	Primary	1.685 (1.066, 2.675)*	
	Secondary	1.448 (0.885, 2.329)	
	Higher (ref.)		
Age in years	15–19	2.210 (1.0454, 4.339)**	<0.0002
	20–24	1.612 (1.143, 3.052)**	
	25–29	1.334 (0.708, 2.515)	
	30–34	1.132 (0.6071, 2.139)	
	35–39	0.842 (0.435, 1.994)**	
	40–44	0.811 (0.410, 1.635)	
	45–49 (ref.)		
Region	Tigray	2.269 (1.249, 4.114)***	<0.0001
	Afar	1.935 (1.093, 3.466)***	
	Amhara	0.919 (0.469, 1.799)	
	Oromia	1.013 (0.554, 1.808)	
	Somalie	0.885 (0.510, 1.533)	
	Benishangul	0.866 (0.432, 1.549)	
	SNNPR	0.985 (0.536, 1.809)	
	Gambela	3.736 (2.098, 6.652)***	
	Addis Ababa	0.731 (0.395, 1.351)	
	Dire Dawa	0.864 (0.466, 1.667)	
	Harari (ref.)		
Wealth index	Poorest	3.294 (2.415,4.516)*	0.0001
	Poorer	523 (1.732, 3.675)	
	Middle	645 (2.437, 5.489)**	
	Richer	3.979 (2.468, 5.991)**	
	Richest (ref.)		
Smoking	No	0.567 (0.249, 1.325)	0.2374
	Yes (ref.)		
Occupation	Unemployment	0.721 (0.567, 0.912)	0.0083
	Merchant and government employee	0.588 (0.429, 0.801)**	
	Other personal work	0.942 (0.554, 1.605)	
	Farmer and laborer (ref.)		
Interaction			
	Wealth × Age	1.1842	<0.0001

BMI: body mass index; aOR: adjusted odds ratio; CI: confidence interval; SNNPR: Southern Nations, Nationalities, and People's region.
***$p \leq 0.001$, **$p \leq 0.01$, *$p \leq 0.05$.

less likely to be underweight compared to farmer and labor workers.

The ethnicity of men was an important biological determinant of BMI in addition to fever, anemia, and smoking cigarette. Ethnicity in the Ethiopian context is highly associated with the lifestyle, place of residence, means of livelihood, and culture of each ethnic group, which in turn results in differing BMI status. However, in a study by Mashinya et al.,[17] findings indicate that among men, there was a negligible difference in the obesity and overweight combined prevalence by ethnicity but a significant effect on BMI of women. This is in contrast with the results of this study, which figured out that caution should be taken in interpreting BMI from different racial/ethnic group.[32] A study on adult Nigerians found that anemia has no definite relationship with BMI and sociodemographic characteristics.[33] In this study, however, the reverse is true. Men who do not have anemia complications were less likely to be underweight as compared to men who had anemia, which supports a study on women in China.[34] Men from Amhara, Nuwer, and Aniywak were slightly more likely to be underweight as compared to men from Welaita.

It was also found that for women, age, wealth index, employment or occupation, region, and educational attainment significantly associated with BMI.[35,36] In contrast, education attainment and smoking cigarettes had no significant association existing between BMI Zimbabwe.[11] That is, the prevalence of overweight and obesity was similar across all educational levels. The effect of

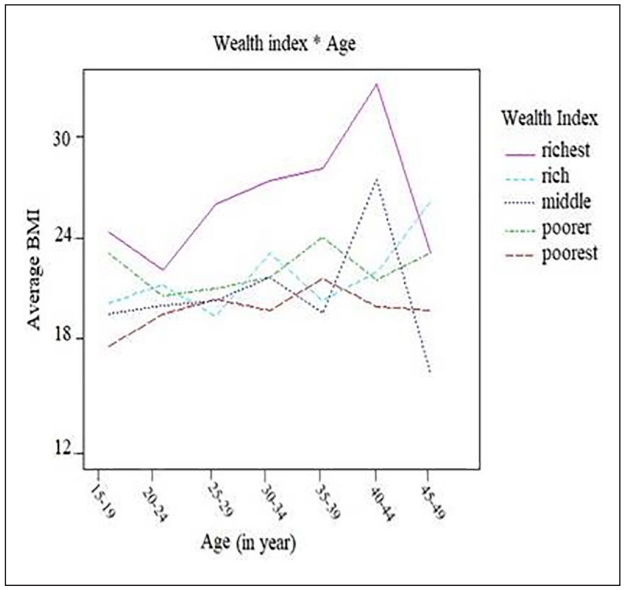

Figure 4. Interaction plot between wealth index and age characteristics of women.

women's wealth index on BMI varies depending on the age of women[11] and underweight remains a problem among the poorest women in poor countries.[37] One socioeconomic indicator, occupation type, also had a significant effect on BMI, which is in line with reports from Tesfaye et al.[11] evidenced on Zimbabwean women. In the case of both men and women, wealth index was an important significant factor associated with BMI, which is in line with a study by Hruschka and colleagues.[1,22] Finding on 32 African countries also reported that prevalence of overweight and obesity varied highly between the countries and wealth index.[38] Finally, even though khat chewing is slightly statistically insignificant in this study ($p = 0.0625$), it is known in practice that it has a mixed effect on BMI. People chewing khat must remain seated and calm, which may increase the chance of being overweight/obese, while on the contrary, khat chewing results in rising body temperature while chewing and loss of appetite, which may result in being underweight.[39,40] It needs further study toward its effects. Therefore, the authors would like to inform policy makers and stakeholders in Ethiopia that the household wealth index is an important determinant of the nutritional status of men and women aged 15–49 years.

Conclusion

In Ethiopia, wealth index is an important socioeconomic determinant of BMI among men and women of ages 15–49 years. The poorest people were more likely of being underweight than the richest and richer people, and vice versa for obese. A high prevalence of underweight, and overweight, and obesity was observed, which might aggravate for the occurrence of related non-communicable diseases. It was also found that the effect of socioeconomic, biological, behavioral, and demographic factors on BMI is different for men and women. The authors recommend that the government, as well as stakeholders, need to give serious attention to addressing the problems associated with underweight, overweight and obese.

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Author contributions

E.K.M. conceived the study and advised on analysis. L.M.T. proposed the first draft and conducted data analysis, interpretation, and prepared all figures and tables. E.K.M. and L.M.T. wrote the manuscript. Both authors read and approved the final manuscript.

Availability of data and material

The datasets for generated analyses during the study are available in Ethiopian Demographic and Health Survey data if a unique request is sent via their site EDHS 2016.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

Ethical approval for this study was done by Central Statistical Agency to conduct Ethiopian Demographic and Health Survey in 2016 to update the current health status of the community for policymakers and different stakeholders (Waiver No. ETH/CSA/516/V.16/2016).

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