Obesity and associated factors among high school adolescent students in Bahir Dar town, North West Ethiopia: A cross-sectional study

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Abstract

Objective: The aim of this study was to assess the magnitude and associated factors of obesity among high school adolescent students in Bahir Dar, Ethiopia.

Methods: An institution-based cross-sectional study was conducted from 10 September 2019 to 10 October 2019 in Bahir Dar town. A total of 1018 students were enrolled using a multistage sampling procedure. Epidata version 3.1 was used for data entry, and SPSS version 24 was used for data analysis. A bivariable and multivariable logistic regression analysis was performed.

Results: The magnitude of obesity among high school adolescents was 8.3%. Attending a private school (adjusted odds ratio = 6.52; 95% confidence interval: 3.13, 13.59), not participating in moderate- to vigorous-intensity activities (AOR = 3.08; 95% confidence interval: 1.44, 6.64), coming from a wealthy family (adjusted odds ratio = 7.03; 95% CI: 2.16, 22.89), and snacking frequency (adjusted odds ratio = 9.64; 95% confidence Interval: 4.79, 19.39) were all associated with obesity.

Conclusions: Obesity was prevalent among students in private schools and wealthy families in the research area. Family size, household wealth, participation in moderate-to-striving activities, and snacking frequency were all found to be significant factors of obesity.

Keywords

Overweight, obesity, school adolescent, factors, Ethiopia

Introduction

Obesity and being overweight are characterized as abnormal or excessive fat accumulation that might harm one's health. Overweight is defined as a body mass index (BMI) of $>1 + SD$ (equivalent to a BMI of greater than or equal to 25kg/m^2 at age 19 years). Obesity is defined as a BMI of $>+2$ SD (corresponding to a BMI of more than or equal to 30kg/m^2 at age 19).[1] The BMI is a simple weight-for-height index that is often used to identify humans as overweight or obese.[2]

According to current evidence, obesity is a multifactorial condition influenced by various variables, such as genetic, demographic, and lifestyle factors.[2] Globally, the primary causes of obesity are increased consumption of energy-dense foods with high fat content, an increase in physical inactivity due to the increasingly sedentary nature of many forms of work, shifting modes of transportation, and urbanization.[3]

Adolescents' nutritional state has a significant impact on their current and future health. Obesity is a serious public health issue that is spreading at an alarming rate around the

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Table 1. Sample size calculation for the second objective in a study on obesity.

Variable name	% outcome in exposed group	% outcome in unexposed group	OR
Having family vehicle	29.30	14.04	2.54
Frequency of eating snack per day	42.67	12.90	5.03
Eat when watching TV per film	18.97	3.22	7.02
Type of school	23.90	12.50	1.93
Vigorous activity	20.21	10.07	2.26

globe. Every year, at least 2.8 million people die as a result of being overweight or obese.[4–7]

Africa's urban population is seeing a change from underweight to overweight as well as a rapid social and nutritional revolution. Currently, 20%–50% of African urban populations are overweight or obese. By 2025, non-industrialized countries will account for three-quarters of the world's obese population.[8–10]

Children with obesity can develop psychosocial problems because their weight can be perceived as a significant handicap by them and others. Adolescence may be the period of greatest risk for those with these disorders. Adults who have been obese since childhood are more likely to suffer from psychological disorders.[11]

According to a study conducted in Saudi Arabia, the most frequent risk factor for obesity was an increase in daily food consumption.[12] Obesity among schoolchildren in big cities is associated with overweight parents, insufficient exercise, excessive levels of sedentary behavior, improper food consumption, and family history.[13,14] Similarly, sex, the quantity and frequency of eating out, the kind of school, the family's monthly income, the family's use of vehicles, and the frequency of strenuous physical activity are some of the factors to consider.[15]

As one study advocates: Reduce the fat, sugar, and salt content of processed foods at the industry level; ensure that healthy and nutritious options are available and affordable to all consumers; and then practice responsible marketing, particularly marketing to children and adolescents.[16] However, studies concerning overweight and obesity among students are limited. Therefore, this study was conducted to determine the magnitude and risk factors of obesity among adolescent students.

Materials and methods

Study design and study setting

An institution-based cross-sectional study was conducted in Bahir Dar from 10 September 2019 to 10 October 2019. Bahir Dar, the capital city of Amhara Regional State, is 552 km from Addis Ababa (the capital city of Ethiopia). It has a total population of 296,433 people. The town is divided into 26 kebele administrations, 6 sub-city administrations, and 4 satellite kebele administrations.

There are 19 high schools in Bahir Dar, 11 of which are governmental, and the remaining 8 are private. In the 2018–2019 school years, a total of 12,686 grade 9 and 10 students were enrolled in all high schools, with 6662 of the students being female and the remaining 6024 being male.

Population

The source populations were all regular grade 9 and 10 adolescent students in Bahir Dar town. The study populations were all randomly selected regular 9th and 10th grade adolescent students from the selected high schools during the study period.

Inclusion and exclusion criteria

All regular adolescent students of grade 9 and grade 10 in Bahir Dar Town in the year 2019 were included in the study. Students who were severely ill, non-volunteers, and those students who were absent during the data collection period were excluded.

Sample size determination and sampling procedures

Sample size was determined using the double population proportion formula using Epi Info with the assumptions of a 95% confidence level, 80% power, a proportion of vigorous activity in the exposed group of 0.20, and a proportion of vigorous activity in the unexposed group of 0.10.[15] By considering a non-response rate of 10% and multiplying by a design effect of 2, the second objective sample size was 1060 (Table 1).

A multistage sampling technique was used to select study participants, and stratification was done based on the type of school (i.e. private or governmental). There are 19 high schools, of which 11 are governmental and 8 are private. Then the total sample size was allocated proportionally to each selected high school. Finally, study participants were selected using a simple random sampling method from the list of students in each grade at each school using a computer-generated random number (Figure 1).

Data collection procedure and data quality control

The data was collected using a self-administered questionnaire, which was adopted from the Global Physical Activity

Questionnaire Analysis Guide and the WHO Steps instrument for chronic disease risk surveillance.[17,18] The questionnaire was first prepared in English, and then translated into Amharic, and then translated back to English. Training was given to data collectors and supervisors. The questionnaire was reviewed and checked for completeness, accuracy, and consistency by the supervisor and principal investigator on the spot.

Operational definition

Adolescent: individuals in the age group 10–19 years.[19]

Moderate-intensity activities: activities that require moderate physical effort and cause small increases in breathing or heart rate, such as brisk walking (or carrying light loads) per day for at least 10 min continuously.

Overweight: BMI for age $>+1$ standard deviation (equivalent to BMI 25 kg/m^2 at 19 years).[1]

Obesity: BMI for age $>+2$ standard deviation (equivalent to BMI 30 kg/m^2 at 19 years).[1]

Vigorous-intensity activities: activities that require hard physical effort and cause large increases in breathing or heart rate, such as carrying or lifting heavy loads, digging, or construction work, per day for at least 10 min continuously.

Work besides learning: any work that involves moderate- to vigorous-intensity activity, like carrying or lifting heavy loads, digging, or construction.

Sweet food items: foods like cake, biscuits, ice cream, chocolate, and the like.

Type of school: indicate school which is governmental or private.

Poorest quintile: the wealth status of households in the lowest 20% of households.

Wealthiest quintile: the wealth status of households in the highest 20% of households

Statistical analysis

Data was coded, cleaned, and entered into Epidata before being analyzed with SPSS version 24. BMI for age and sex was computed using WHO Anthroplus software. Principal component analysis was used to assess the household wealth status, and components were developed using items with Eigen values greater than one. Finally, household wealth status was ranked as poorest, poor, medium, wealthy, and wealthiest. Descriptive statistics, both bivariable and multivariable logistic regression analyses, were done.

Results

Socio-demographic characteristics of the respondents

A total of 1018 students participated in this study, with a response rate of 96.1%. More than half of the respondents 541 (53.1%) were females. The median age of the students was 16 ± 2 IQR, their median height was 1.63 ± 0.10 m IQR and their median weight was 52 ± 9.1 kg IQR.

About 830 (81.5%) of the respondents were from government schools, and the rest were from private schools. About 371 (36.4%) of them were in families of less than 4, and the rest were in families of four or more. The majority of the households (840 (82.5%)) were headed by men. About 389 (38.2%) of the households were headed by college-educated or higher-educated family members.

The combined magnitude of overweight and obesity in the study area was 8.3% (95% CI: 6.7%, 10.2%). Overweight accounted for 6.8% (95% CI: 5.3%, 8.5%) and obesity 1.6% (95% CI: 0.8%, 2.4%). The magnitude of overweight and obesity among girls and boys was 10.5% and 5.9%, and among private and governmental high school students, it was 20.74% and 5.5%, respectively. Among 1018 respondents, 67.0% were well-nourished, 24.6% were malnourished, 6.8% were overweight, and 1.6% were obese (Figure 2).

Eating and physical activity habits of respondents

Among 1018 respondents, 361 (35.4%) consumed vegetables 2–6 times per week; 246 (24.1%) consumed cereals 2–6 times per week; 211 (20.7%) consumed milk 2–6 times per week; 291 (28.5%) consumed legumes 2–6 times per week; 201 (19.8%) consumed fat-containing foods 2–6 times per week; 242 (23.8%) used sweet foods 2–6 times per week; 638 (79.6%) used snacks 1–2 times per day; 164 (20.4%) 3 or more times per day.

Four hundred forty-four people (48.6%) ate while watching television or a movie. 171 (16.8%) ate when studying. The majority of respondents (65.4%) have three meals per day, 157 (15.5%) have two meals, and 114 (11.2%) have four or more meals per day, except snacks.

Of the 1018 respondents, 428 (42.0%) were engaged in any moderate or vigorous exercise, 380 (51.8%) for 5–7 days, 247 (33.7%) for 3–4 days, and 168 (22.9%) for 30 min continuously for 1–2 days (Table 2).

Factors associated with overweight and obesity

School type, age, sex of adolescents, family size, sex of family head, fruit intake, sweet food intake, frequency of snack intake, moderate or vigorous intensity sports activity, mode of transportation, and household wealth status were eligible for multivariable logistic regression analysis. Among these, school type, age, family size, moderate or vigorous intensity sports activity, frequency of snack use, and household wealth status were significantly associated with obesity at the $p < 0.05$ level of significance.

Adolescent students from private schools were 6.52 times more likely to be overweight or obese as compared to students from government schools. Early adolescent students were 2.45 times more likely to be overweight or obese.

Table 2. Obesity and physical activity characteristics of high school adolescent students.

Variable		Obesity Yes *n* (%)	No *n* (%)
Moderate to vigorous activities besides Learning	Yes	20 (1.90)	408 (40.10)
	No	65 (6.40)	525 (51.60)
Number of days Moderate to vigorous activities besides Learning	1–2 day	13 (3.04)	91 (21.30)
	≥3 day	33 (7.71)	318 (74.30)
Vigorous sport activity that cause large increase in HR or breathing for at least 10 min continuously	Yes	60 (5.90)	607 (59.60)
	No	25 (2.40)	326 (32.10)
Number of days vigorous sport activity that cause large increase in HR or breathing for at least 10 min continuously	1–2 days	23 (3.45)	256 (38.40)
	3–4 days	27 (4.04)	232 (34.80)
	5–7 days	7 (1.04)	119 (17.80)
Times of vigorous intensity sport that cause large increase in HR or breathing for at least 10 min continuously	<2 h	48 (7.20)	539 (80.80)
	2–3 h	9 (1.30)	45 (6.70)
	>3 h	0 (0.00)	23 (3.44)
Moderate intensity sport that cause small increase in HR or breathing for at least 10 min continuously	Yes	57 (5.60)	650 (63.90)
	No	28 (2.70)	283 (27.80)
Number of days moderate intensity sport that cause small increase in HR or breathing for at least 10 min continuously	1–2 days	29 (4.10)	281 (39.70)
	3–4 days	11 (1.56)	243 (34.40)
	5–7 days	17 (2.40)	126 (17.80)
Number of times moderate intensity sport that cause small increase in HR or breathing for at least 10 min continuously	<2 h	50 (7.10)	536 (75.80)
	2–3 h	1 (0.14)	92 (13.01)
	>3 h	6 (0.80)	22 (3.11)
Time Spent in watching TV per day	≤3 h	68 (6.70)	713 (70.00)
	>3 h	17 (1.70)	220 (21.60)
Mode of transportation	On foot	32 (3.10)	532 (52.30)
	By car	53 (5.20)	401 (39.40)

HR = Heart rate.

Adolescent students whose household wealth status was in the wealthy quintile were 7.03 times more likely to be overweight or obese (Table 3).

Discussion

According to the findings of this study, the magnitude of obesity among high school adolescent students in Bahir Dar town was 8.3%. This finding was consistent with a study conducted in Tanzania.[20] But it is lower than a study done in Morocco, India, and Addis Ababa.[21–23] The possible reasons might be that in the current study, most of the students might come from rural areas in which most of the students are prone to heavy workload and regular exercise. However, the previous areas are more urban, and the students' residence lifestyle makes them more susceptible to obesity. This implies they have limited exercise, different eating styles, and luxury way of life. These may be because of differences in cultural, socio-demographic, and economic conditions, and sample size.

The type of school attended was significantly associated with obesity. Adolescents attending private schools were 6.52 (3.13, 13.59) times more likely to be obese than those attending public schools. This finding is consistent with a study done in Jimma and Hawassa towns.[24,25] The possible explanation may be that most of the students who attended

private schools are from wealthy families. However, it was inconsistent with a study conducted in Saudi Arabia and Andhra Pradesh, India.[3,22] This could be due to a difference in the socioeconomic status of the families, cultural differences, sedentary lifestyles such as transportation access, and exposure to energy-dense foods. We know that adolescents from high-income families are more likely to experience nutrition transition and sedentary behavior in developing countries. Similarly, the differences might be due to study areas. In Saudi Arabia, the study population consisted of students who only attended private schools.

The age of adolescent students was significantly associated with obesity, with early adolescents being 2.45 times more likely to develop obesity than late adolescents. This was inconsistent with the study done at Jimma.[24] This could be due to differences in population and feeding habits. Similarly, most of the time, early adolescents eat creamy snacks. Late adolescent students, in contrast, spend their time away from home keeping domestic animals, which increases the likelihood that they would not have enough to eat. The population in Jimma commonly used Enset as part of their diet, whereas in the current study, nothing is eaten from Enset products such as Bula and Kocho. These cultural food products that are obtained from Enset are known to have high starch contents.

Adolescents from small families were 3.11 (1.64, 5.96) times more likely to be obese than adolescents from four or

Table 3. Factors associated with obesity among high school adolescent students.

Explanatory variables	Obesity		COR	AOR	p-Value
	Yes	No			
Type of school					
Private	39	149	4.46	6.52 (3.13, 13.59)	<0.001
Governmental	46	784		1	
Age of participants					
Early adolescent	55	703	1.67	2.45 (1.13, 5.30)	0.023
Late adolescent	30	230		1	
Sex of family head					
Male	62	778	1.86	2.29 (0.99, 5.29)	0.051
Female	23	155		1	
Household wealth status					
Poorest	6	200		1	
Poor	12	153	2.61	0.73 (0.19, 2.84)	0.648
Medium	14	214	2.18	1.13 (0.34, 3.74)	0.838
Wealthy	36	180	6.67	7.03 (2.16, 22.89)	0.001
Wealthiest	17	186	3.05	2.79 (0.87, 8.94)	0.83
Family size					
≤4	51	320	2.78	3.11 (1.64, 5.96)	0.001
>4	34	613		1	
Mode of transportation to and from school					
On foot	32	532		1	
By car	53	401	2.19	1.73 (0.90, 3.33)	0.098
Moderate to vigorous intensity activity besides learning					
Yes	20	408		1	
No	65	525	2.53	3.09 (1.44, 6.64)	0.004
Sweet food intake per week					
None	12	201		1	
Once and less than 1 per week	14	412	0.57	0.19 (0.06, 0.56)	0.063
2–6 times per week	31	211	2.46	1.85 (0.73, 4.69)	0.192
≥1per day	11	126	1.46	1.33 (0.48, 3.68)	0.578
Fruit intake per week					
None	40	244	1.31	3.02 (0.25, 36.59)	0.385
≤1 times per week	43	633	0.54	0.82 (0.07, 9.76)	0.879
2–6 times per week	1	48	0.17	0.19 (0.01, 5.35)	0.327
≥1 time per day	1	8	0.13	1	
Frequency of using snack					
1–2 times per day	36	602		1	
≥3 times per day	35	129	4.53	9.64 (4.79, 19.39)	<0.001

more family sizes. This is consistent with a study conducted in Addis Ababa.[23] The possible reasons might be that adolescents from small families could get enough food as compared to those from large families. There might be an equitable sharing of food dietaries among children.

Students who did not engage in any moderate or vigorous sports activity for at least 10 min were 3.09 (1.44, 6.64) times more likely to be obese than those who engaged in moderate or vigorous sports activity for at least 10 min. This finding is consistent with other studies.[3,22,24] This could be because physical activity determines the number of calories spent or stored as fat in the body and maintains a healthy weight

status, and physical activity results in energy expenditure, which reduces adiposity in the body.

This finding revealed that the wealth status of adolescents' households was significantly associated with obesity. Adolescents in wealthy households were 7.03 (2.16, 22.89) times more likely to be obese than those in the poorest household wealth status quintiles. This finding is consistent with a study conducted in Jimma and Hawassa.[25,26] This could be because adolescents from higher-income households consume more energy-dense and protein-rich foods. Adolescents in the highest socioeconomic status group also spent far more time watching TV and had a limited workload as well
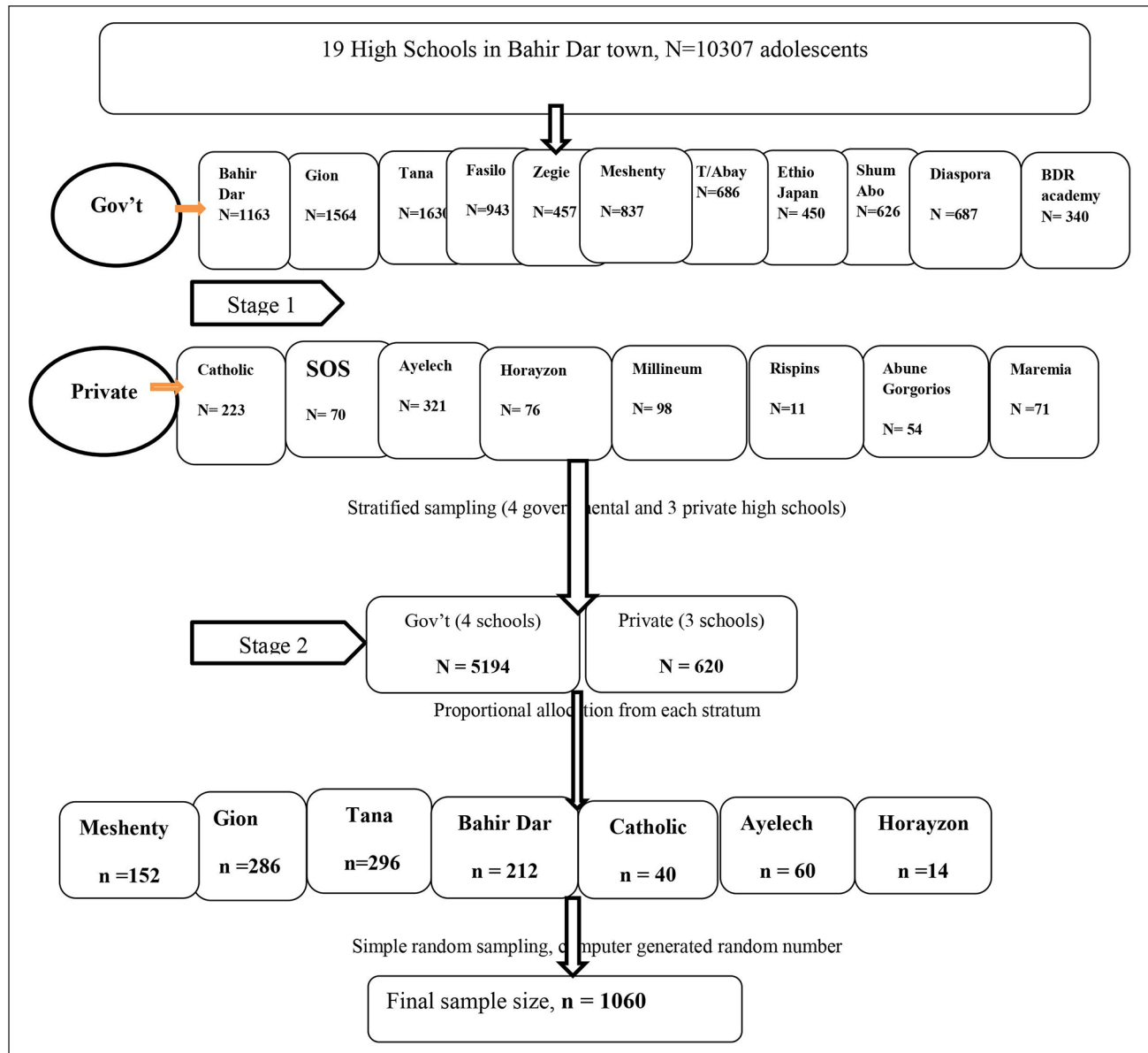
Figure 1. Sampling procedure of high school adolescent students in Bahir Dar town.

as limited daily activities. This result also is comparable with a study conducted in Butajira, Ethiopia.[27]

Adolescents who ate snacks three or more times per day were 9.64(4.79, 19.39) times more likely to be obese. This finding is supported by research conducted in India and Bahir Dar.[22,28] This could be due to exposure to sweet foods and other high-calorie-containing foods, which are commonly consumed during snack time and may increase body fat, resulting in obesity. The students might have a familial inheritance of obesity due to the common life-sharing conditions.

As a limitation of this study, some factors such as parental weight status, medication use, formula feeding, and nutritional knowledge were not addressed. There could also be a social desirability bias among respondents.

Conclusion

A high prevalence of obesity was found among students of private schools and in the wealthy households in the study area. School type, age, family size, household wealth status, frequency of snack intake, and participation in moderate to vigorous intensity activities were among the factors that were significantly associated with obesity. The students should do regular physical activities and reduce taking highly protein rich foods. In order to lessen the future burden of obesity-related chronic diseases, public health interventions are required to raise awareness among children and adolescents of the risk factors for obesity. School-based health education and promotion strategies in healthy nutritional behavior should also be established.
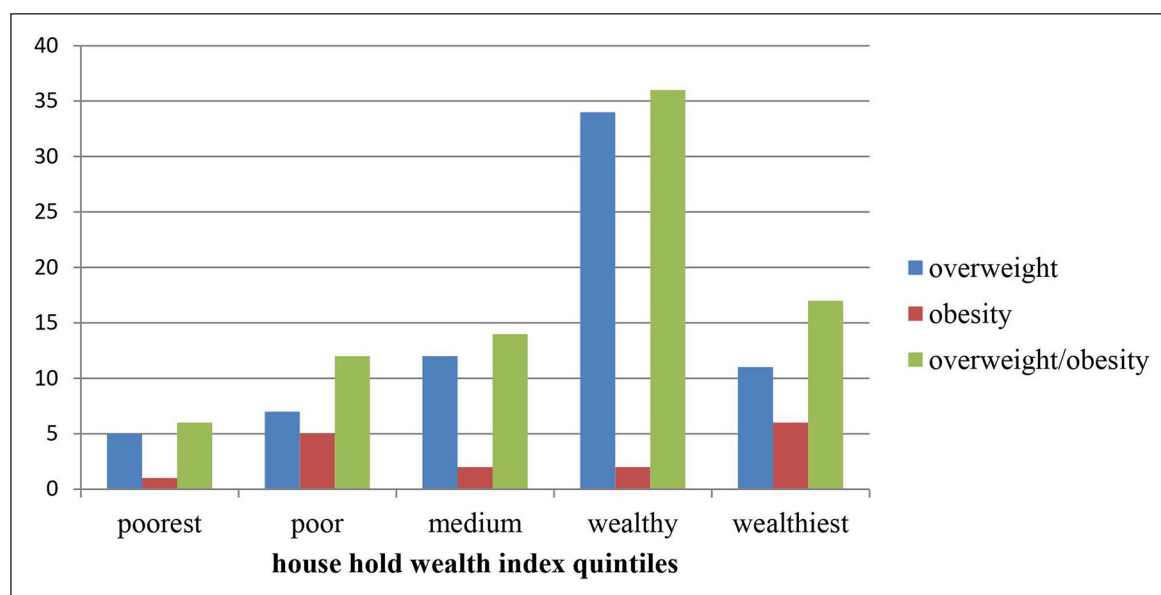
Figure 2. Prevalence of overweight and obesity based on wealth status of households.

Informed consent

Written informed consent was obtained from all subjects before the study. The exceptions for consent to medical treatment for minors fall into two categories. The first is for situations where the minor is married or is the parent of a child. The second is for situations where a minor seeks particular types of treatment.

Based on the second situation, these minor subjects did not require parental or guardians consent because the study did not need medical treatment or did not have injury for individuals under the age of 18 years old. They gave their own written informed consent. These concerns were taken into account by the IRB when approving the study.

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Supplemental material

Supplemental material for this article is available online.

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