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Prevalence and factors associated with overweight and obesity in Kenya

Rahma Mkuu [a,*], Adam Barry [b], Gerald Yonga [c], Fredrick Nafukho [d], Cort Wernz [e], Tamika Gilreath [f], Muhammad A.B. Chowdhury [g], Idethia Shevon Harvey [h]

[a] University of Florida, P.O Box 100177, Gainesville, FL 32616, United States
[b] Texas A&M University, 108 GGB, 2929 Research Pw, College Station, TX 77843, United States
[c] University of Nairobi, KNH, P. O. Box 19676, Nairobi, Kenya
[d] Texas A&M University, 804B EDCT, 540 Ross St, College Station, TX 77843, United States
[e] Baylor College of Medicine, One Baylor Plaza, Houston, TX 77030, United States
[f] Texas A&M University, 311F BLOC, 155 Ireland St, College Station, TX 77843, United States
[g] University of Florida, PO Box 100186, Gainesville, FL 32610, United States
[h] Texas A&M University, 266 GGB, 2929 Research Pw, College Station, TX 77843, United States

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ABSTRACT

Overweight and obesity rates continue to rise globally and are associated with increased chronic disease morbidity and mortality. There is evidence of high overweight and obesity prevalence in Kenya, however; a gap exists in the knowledge of national prevalence and predictors of overweight and obesity.

This cross-sectional study examined data from the 2015 World Health Organization (WHO) Kenya STEPwise Survey—the first nationally representative survey to objectively measure body mass index (BMI) among Kenyan men and women. Descriptive and logistic regression analysis of 4,340 adults aged 18–69 years examined the prevalence, sociodemographic, and behavioral risk factors associated with having overweight or obesity (overweight/obesity) defined by WHO

The mean BMI was 23.51 with 31.13% having overweight/obese. The likelihood of having overweight/obesity was significantly higher among married individuals [odds ratio (OR) = 1.78, 95% confidence interval (CI) 1.19, 2.66], women (OR = 4.08, 95% CI 3.02, 5.51), urban dwellers (OR = 1.70, 95% CI 1.28, 2.25) and middle wealth or higher (OR = 2.45, 95% CI 1.91, 3.14). The likelihood of having overweight/obesity increased by age, compared to 18–29-year olds; (30–44 years (OR = 2.05 95% CI 1.50, 2.80), 45–59-year olds (OR = 2.67, 95% CI 1.97, 3.63), 60–69-year olds (OR = 3.00, 95% CI 1.99, 4.51). Adults with completed primary education or more had higher odd of having overweight/obesity (OR = 2.15, 95% CI 1.72, 2.70). compared to adults with less than primary education.

Likelihood of having Overweight/obesity was highest among women, urban residents, and individuals with high education and wealth. Future studies should ascertain drivers of overweight/obesity to inform Targeted and tailored interventions and policies amongst high-risk groups.

1. Introduction

Global estimates contend that approximately 1.9 billion adults are classified as overweight or obese worldwide, representing a two-fold increase since 1980 (World Health Organization, 2017d). In low middle-income countries (LMICs), prevalence rates for overweight and obesity are increasing (Ford et al., 2017). In Kenya specifically, there is a growing body of literature focused on overweight and obesity prevalence rates (Joshi et al., 2014; Kimani-Murage et al., 2015; Mbochi et al., 2012; Mkuu et al., 2018; Ondicho et al., 2016).

Overweight and obesity is a clear public health challenge given its association with increased risk of several non-communicable diseases (NCDs), such as heart disease, cancer, and type-2 diabetes (T2D), the leading causes of morbidity and mortality worldwide (Benjamin et al., 2018). Researchers in Kenya also link obesity to increased risk of NCDs such as T2D and cardiovascular risk (Ayah et al., 2013; Kaduka et al., 2012; Mathenge et al., 2010; Oti et al., 2013).

Despite research outlining the high prevalence and adverse health

* Corresponding author.
E-mail addresses: rmkuu@ufl.edu (R. Mkuu), aebarry@tamu.edu (A. Barry), fnafukho@tamu.edu (F. Nafukho), cort.wernz@bcm.edu (C. Wernz), isharvey@tamu.edu (I. Shevon Harvey).

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outcomes associated with overweight and obesity in Kenya, there is a paucity of information examining the nationwide demographic characteristics and health-related behaviors associated with the conditions. The few studies report that the prevalence of obesity is higher among those living in urban areas, women, and individuals with higher income (Steyn et al., 2011; Pawloski et al., 2012; Christensen et al., 2008).

We are unaware of research examining the prevalence and predictors of overweight and obesity using a national sample of Kenyan men and women. Few studies have explored the relationship between health behaviors, overweight, and obesity, among Kenyans. Thus, the objectives of this paper are two-fold. First, we will examine the sociodemographic characteristics associated with likelihood of having overweight or obesity in Kenya. Second, we will ascertain the relationship between overweight or obesity and health behaviors (e.g., alcohol consumption, and fruits and vegetables (FV) consumption). These factors were specifically chosen given that alcohol consumption (Traversy and Chaput, 2015), and FV consumption (Schwingshackl et al., 2015) are well recognized factors influencing overweight and obesity.

2. Methods

2.1. Sample

This cross-sectional used secondary data from the 2015 WHO Kenya STEPwise Survey, an assessment including 4,350 adults aged 18 – 69 years residing in Kenya. The survey was designed to provide nationwide indicators associated with NCDs for adults 18 – 69 years of age. The survey used a multistage probability sampling by region (e.g., urban versus rural), household, and sex and age groups of the Kenya National Bureau of Statistics, Fifth National Sample Surveys and Evaluation Programme (NASSEP V) generated from Kenya's 2009 Population Housing Census (Kenya Ministry of Health, 2015). Further information regarding the sampling frame can be found in the 2015 Kenya WHO STEPWise report (Kenya Ministry of Health, 2015).

Inclusion criteria for WHO STEPwise required individuals to be: (World Health Organization, 2017d) between 18 and 69 years of age, and (Ford et al., 2017) able to provide informed consent for participation (Kenya Ministry of Health, 2015). A total of 4,500 eligible adults, aged 18 to 69 years, participated in the survey, representing a response rate of 95% (Kenya Ministry of Health, 2015). For our study, we excluded women who reported to be currently pregnant (N = 136, 3.02%) because we did not have information about pre-pregnancy BMI, thus reducing potential bias from not controlling for pregnancy related weight gain. We also excluded individuals under the age of 18 during data cleaning (N = 14, 0.31%).

3. Dependent variables

Body mass index. Weight in kilograms and height in centimeters were collected. Body Mass Index (BMI) was calculated by dividing the weight in kilograms by meters squared. A BMI between 25.0 and 29.9 was defined as overweight and a BMI of $\geq$ 30.0 defined as obese (World Health Organization, 2017d). A dichotomous outcome variable of overweight or obese (overweight/obese) was established and coded as follows: underweight/normal (BMI $\leq$ 24.99) = 0, and overweight/obese (BMI $\geq$ 25) = 1. Underweight is typically a risk factor associated with other health issues, since the purpose of this study was to focus on individuals with overweight or obese, we categorized underweight and normal as one reference group (Nazri et al., 2020).

4. Independent variables

Demographic Characteristics. Participant demographic characteristics were assessed using biological sex (woman = 1, male = 0); age recorded into the following age groups (18–29 = 1, 30–44 = 2, 45–59 = 3, and 60–69 = 4); education as a categorical variable re-coded as (less than primary education = 0, completed primary education or above = 1); marital status as a categorical variable re-coded as (married/cohabitating = 1, separated/divorced = 2, never married = 3, and widowed = 4); residence as a categorical variable re-coded as (rural = 0, urban = 1); and wealth index as a categorical variable based on a composite score of cumulative household assets and re-coded as (poorest/poor = 0, middle/rich/and richest = 1).

Health Behaviors. Health behaviors examined were alcohol consumption in the last 30 days (yes = 1, no = 0); and average FV consumption. Literature supports that specific time frames such as inquiring about alcohol consumption in the last 30 days improves reliability and validity of self-reported alcohol consumption.

The World Health Organization recommends 5 or more services of fruits and vegetables per day for health benefits. Fruits and vegetable (FV) consumption involved examining the reported frequency of consuming FV using the following four questions: 1) *In a typical week, on how many days do you eat fruit?* 2) *How many servings of fruit do you eat on one of those days?* 3) *In a typical week, on how many days do you eat vegetables?* and 4) *How many servings of vegetables do you eat on one of those days?* A nutrition card with examples of local fruits and vegetables was displayed to participants to give examples for serving size. A continuous variable of average fruits and vegetables consumed during a typical day was calculated. The variable was calculated first by multiplying the number of days the participants consumed fruit by the number of servings reported in a typical day. The number was then divided by 7 to create a daily consumption average. The daily average number of vegetables consumed was calculated using the same formula. After, a continuous score of average FV in a typical day was constructed by summing the average fruit and average vegetables on a typical day. The continuous variable was used in the model. A dichotomous variable was also calculated measuring whether participants consumed at least 5 servings of FV as recommended by the WHO for descriptive purposes (World Health Organization, 2017).

5. Analysis

Data analysis was conducted using Stata version 15.0 (StataCorp LP, College Station, TX). The data was weighted during analysis to account for the multistage cluster sampling design using "svyset" commands that account for stages of sampling. Data weighting prevents underestimation of sampling error as statistical packages often assume data was collected using simple random sampling (Treiman, 2014).

Descriptive analysis was conducted to provide details on demographic characteristics of the sample. Proportions for categorical variables and means and standard deviations for continuous variables were calculated. Chi-Squared test was used to examine significant demographic characteristics associated with being overweight/obese. Logistic regression analysis was conducted first to examine demographic characteristics that were significantly associated with the outcome variable being overweight/obese (No = 0, Yes = 1).

An interaction of education and wealth status was significant (DF 198, N = 4,340, $p < 0.001$). The interaction model demonstrated no significant interaction effect between education and wealth status and being overweight or obese (OR = 0.87, 95% CI 0.57 – 1.34).

Logistic regression models were also conducted to examine the relationship between overweight/obese and NCD health-related behaviors, (i.e., sedentary activity, consumption of fruits and vegetables, and alcohol consumption) controlling for sociodemographic variables, gender, age, marital status, education, residence, and wealth that have been found to influence overweight and obesity status in Kenya (Mbochi et al., 2012; Mkuu et al., 2018; Ondicho et al., 2016; Ayah et al., 2013). A p-value of <0.05 was considered significant.

6. Results

6.1. Sociodemographic results

We examined the shape of BMI using the kernel density plot by urban and rural areas (Fig. 1). Both urban and rural BMI distribution curves appear to be skewed to the right, indicating a gradual increase in BMI. Table 1 describes the study participants' demographic characteristics and health behaviors of the sample by overweight or obesity status. The mean age of participants was 37.50 (SD 13.41) with majority being under the age of 44 years. 18–29-year olds made up 45.70% of the sample and 30–44-year olds made up 32.58% of the sample. The sample was evenly distributed by biological sex, with near equal representation of men (50.61%) and women (49.39%). Overall, the majority of the sample were married or cohabitating (64.15%), lived in rural areas (61.63%), had completed primary education or greater (64.49%), and were in the middle to richest wealth categories (60.25%). The mean BMI of the sample was 23.51 (SD 5.66). About a third (31.13%) of participants were classified overweight or /obese. The proportion of participants who consumed alcohol within the past month was 19.78%. The proportion of participants who reported consuming the recommended 5 or more servings of FV per day was 6.2%.

The overall prevalence of overweight or obesity was 31.13% (95% CI 29.76, 32.53). The prevalence of obesity was higher among women (38.51% (95%CI: 34.48, 42.71) than men 17.61% (95% CI: 13.72, 22.31). The prevalence of overweight or obesity was higher among adults with completed primary education or higher 32.84% (95% CI: 29.34, 36.54) compared to those with less than primary education 19.06% (95% CI: 16.07, 22.46). Adults in the middle-richest wealth category had higher prevalence of overweight or obesity 35.87% (95% CI: 32.15, 39.77) compared to adults in the poor-poorest wealth category 15.94% (95% CI: 13.71, 18.46). The prevalence of overweight or obesity among urban adults were 36.70% (95% CI: 32.08, 41.58) compared to rural adults 22.49% (95% CI: 19.39, 25.92).

Logistic Regression Results: Factors of Overweight or **Obesity**

Table 2 demonstrates the logistic results of sociodemographic characteristics associated with having overweight or obesity. A logistic regression analysis model examining the relationship between likelihood of having overweight or obesity and sociodemographic factors (e.g., age, biological sex, marital status, level of education, wealth status, and residence) was significant, $p < 0.001$. The likelihood of having overweight or obesity increased by age. Participants who were between 30 and 44 years of age (OR = 2.05; 95% CI:1.50, 2.80), between the ages of 45–59 years (OR = 2.67; 95% CI: 1.97, 3.63), and between the ages of 60 – 69 years (OR = 3.00; 95% CI: 1.99, 4.51) had significantly higher likelihood of having overweight or obesity compared to participants 18–29 years of age controlling for marital status, biological sex, education, wealth, and residence.

The likelihood of having overweight or obesity was significantly higher among women compared to men (OR = 4.08, 95% CI: 3.02, 5.51), those having primary education or more compared to lower education levels (OR = 2.15, 95% CI:1.72, 2.70), middle class or higher (OR = 2.45, 95% CI 1.91, 3.14) compared to those who were in the poor or poorest wealth categories, and those living in urban areas (OR = 1.70, 95% CI 1.28, 2.25) compared to rural areas controlling for demographic characteristics. Health behavioral factors such as drinking alcohol adequate fruit and vegetable (FV) intake, and the number of minutes spent sitting in a typical day were not significant in the adjusted model predating overweight or obesity.

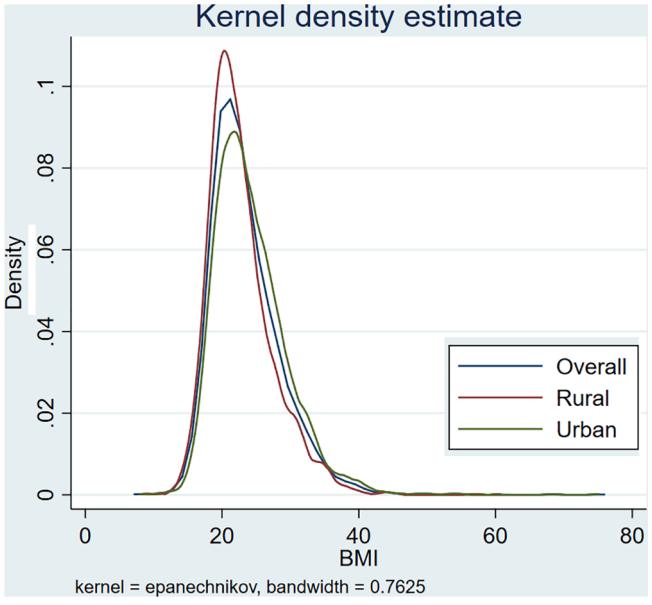

Fig. 1. Kernel density plot of the distribution of body mass index of by place of residence.

7. Discussion

This study sought to examine the national prevalence of overweight or obesity in Kenya and outline sociodemographic and health behavior factors that influence overweight or obesity. The average BMI of the sample was 23.51 with 31.13% being overweight or obese. The prevalence rate of having overweight or obesity in our study aligns with previous studies in Kenya (Mkuu et al., 2018; Steyn et al., 2011) and compares to similar LMICs (Jones-Smith et al., 2012).

The results of this study are comparable to studies showing high prevalence of overweight and obesity among older individuals in Kenya (Kimani-Murage et al., 2015; Mbochi et al., 2012; Ondicho et al., 2016). Given older individuals are at increased risk of being diagnosed with NCDs (Arokiasamy et al., 2017), and overweight and obesity is an established risk factor for NCDs and mortality (World Health Organization, 2017d), it is important to establish strategies and interventions aimed at minimizing weight gain across the lifespan.

Globally, women have the highest risk of being overweight or obese (Ng et al., 2014). Similar to other studies in Kenya showing high rates among women (Mbochi et al., 2012; Mkuu et al., 2018; Ondicho et al., 2016), this study found that women were four times more likely to have overweight or obesity compared to their male counterparts. Among women, overweight and obesity increases the risk of adverse maternal and health outcomes and increases risk for NCDs (Onubi et al., 2016). The increased likelihood of having overweight or obesity among women has been explained by the nutritional transition to high caloric obesogenic diets (Kimani-Murage et al., 2015; Christensen et al., 2008). Consumption behavior might be explained by geographic variability and quality or access to healthy foods (Christensen et al., 2008).

Socioeconomic status (SES) was a significant predictor of higher likelihood of having overweight or obesity. Unlike middle and high-income countries where individuals from low SES are more likely to have overweight or obesity (Ogden et al., 2017; Neupane et al., 2015), studies in Kenya and similar LMICs support findings of higher prevalence of obesity and obesogenic diets with increasing SES (Mbochi et al., 2012; Mkuu et al., 2018; Steyn et al., 2011). Married individuals were also significantly more likely to have overweight or obesity, which may be explained by increase in access to higher wealth or second income. This finding has implications for public health as there may be broader cultural implications, for example, the preference for a larger body size as a sign of high wealth or social status (Ettarh et al., 2013; Appiah et al., 2016; Tuoyire et al., 2017). Thus, public health professionals need to consider more than health education initiatives to curb overweight and obesity in Kenya as cultural and environmental factors may play a more significant role. We recommend further studies to focus on disentangling drivers of overweight or obesity beyond SES in Kenya.

Table 1
Characteristics of the sample by overweight or obesity status, World Health Organization (WHO) Kenya STEPwise Survey, 2015

	Overall SamplePercent (95% CI)	Overweight or ObesePercent (95% CI)	Not Overweight or ObesePercent (95% CI)	p-value
Sex				<0.0001
Men	50.61 (47.99, 53.22)	17.61 (13.72, 22.31)	82.39 (77.69, 86.28)	
Women	49.39 (46.78, 52.01)	38.51 (34.48, 42.71)	61.49 (57.29, 65.52)	
Age Groups				<0.0001
18–29	45.70 (42.13, 49.31)	21.55 (18.69, 24.72)	78.45 (75.28, 81.31)	
30–44	32.58 (30.32, 34.93)	32.42 (27.3, 38.01)	67.58 (61.99, 72.7)	
45–59	16.27 (14.52, 18.18)	35.56 (30.64, 40.8)	64.44 (59.2, 69.36)	
60–69	5.45 (4.57, 6.49)	31.55 (24.66, 39.35)	68.45 (60.65, 75.34)	
Marital Status				<0.0001
Married or Cohabitating	64.51 (61.54, 67.37)	31.7 (28.28, 35.32)	68.30 (64.68, 71.72)	
Divorced or Separated	5.8 (4.75, 7.07)	22.94 (17.04, 30.13)	77.06 (69.87, 82.96)	
Never Married	24.07 (21.1, 27.32)	18.43 (13.77, 24.23)	81.57 (75.77, 86.23)	
Widowed	5.62 (4.71, 6.7)	30.53 (23.92, 38.06)	69.47 (61.94, 76.08)	
Education				<0.0001
Less than Primary	35.51 (30.89, 40.43)	19.06 (16.07, 22.46)	80.94 (77.54, 83.93)	
Complete Primary and above	64.49 (59.57, 69.11)	32.84 (29.34, 36.54)	67.16 (63.46, 70.66)	
Wealth Status				<0.0001
Poor-Poorest	39.75 (33.35, 46.52)	15.94 (13.71, 18.46)	84.06 (81.54, 86.29)	
Middle-Richest	60.25 (53.48, 66.65)	35.87 (32.15, 39.77)	64.13 (60.23, 67.85)	
Residence				<0.0001
Rural	61.63 (53.44, 69.2)	22.49 (19.39, 25.92)	77.51 (74.08, 80.61)	
Urban	38.37 (30.8, 46.56)	36.7 (32.08, 41.58)	63.3 (58.42, 67.92)	
Monthly Alcohol User				0.05
No	80.22 (77.4, 82.77)	29.54 (26.57, 32.7)	70.46 (67.3, 73.43)	
Yes	19.78 (17.23, 22.6)	21.41 (14.88, 29.8)	78.59 (70.2, 85.12)	
Fruit and Vegetables (≥5 serving/day)				0.877
No	93.8 (91.79, 95.34)	28.02 (24.89, 31.38)	71.98 (68.62, 75.11)	
Yes	6.2 (4.66, 8.21)	27.44 (21.26, 34.64)	72.56 (65.36, 78.74)	

Table 2
Unadjusted and Adjusted logistic Regression Results of Sociodemographic Characteristics and Overweight/ Obese.

Covariate	UnadjustedOR (95% CI)	p-value	AdjustedOR (95% CI)	p-value
Age Groups	Ref		Ref	
18–29				
30–44	1.75 (1.38, 2.22)	<0.001	2.05 (1.50, 2.80)	<0.001
45–59	2.02 (1.58, 2.59)	<0.001	2.67 (1.97, 3.63)	<0.001
60–69	1.69 (1.20, 2.38)	0.003	3.00 (1.99, 4.51)	<0.001
Sex				
Men	Ref		Ref	
women	2.95 (2.13, 4.10)	<0.001	4.08 (3.02, 5.51)	<0.001
Marital Status				
Single/Never Married	Ref		Ref	
Married/ Cohabitating	2.06 (1.48, 2.87)	<0.001	1.78 (1.19, 2.66)	0.005
Divorced/ Separated	1.33 (0.77, 2.28)	0.301	0.83 (0.47, 1.45)	0.507
Widowed	1.96 (1.28, 3.00)	0.002	1.24 (0.82, 1.88)	0.313
Education Level				
Less than Primary	Ref		Ref	
Primary Education or more	2.08 (1.62, 2.67)	<0.001	2.15 (1.72, 2.70)	<0.001
Wealth Status				
Poor and Poorest	Ref		Ref	
Middle, Rich and Richest	2.94 (2.34, 3.70)	<0.001	2.45 (1.91, 3.14)	<0.001
Residence				
Rural	Ref		Ref	
Urban	2.01 (1.52, 2.65)	<0.001	1.70 (1.28, 2.25)	<0.001

Individuals from urban areas were significantly more likely to have overweight or obesity supporting other studies in similar LMICs (Mkuu et al., 2018; Steyn et al., 2011; Christensen et al., 2008). The higher overweight and/or obesity among urban dwellers can be explained by exposure to obesogenic environments that increase the risk of overweight or obesity such as higher access to processed foods, low fruits and vegetable access and few and convenient places for physical activity (Mbochi et al., 2012).

No significant associations between average intake FV consumption and being overweight or obese were observed. A very low proportion of adults consumed adequate FV, supporting findings from previous studies in Kenya (Hulzebosch et al., 2015; Muchira et al., 2015). Sedentary activity, a measure increasingly being recognized as a factor influencing NCD risk (Biswas et al., 2015; Thyfault et al., 2015), was also not significantly associated with overweight or obesity. The self-reported nature of the measure might have influenced the findings. Adults in Kenya are reported to have high physical activity (Joshi et al., 2014; Ayah et al., 2013). This study found that current alcohol consumers had lower odds of overweight or obese. The results support findings of complex relationship between alcohol intake and weight gain (Traversy and Chaput, 2015).

8. Strengths and limitations

The cross-sectional nature of the study limits ability to examine trends over time. The use of secondary data limited the breadth and depth of exploration of behaviors. Although the WHO STEPWise survey provides comprehensive behavioral factors associated with NCDs and obesity, the operationalization of some variables was limited. For example, FV intake was measured using recall of both the number of days participants consumed fruits and vegetables and the quantity consumed on an average day. The variable may be profoundly influenced by recall bias. Other nutritional data collection such as 24 or 48-hour dietary recall may elicit the improved memory of the participants' dietary habits (Rutishauser, 2005).

Despite the limitations, this study provides a foundation as the first nationally representative sample to examine overweight and obesity in Kenya among both men and women. This study is the first to examine the prevalence rate of overweight and obesity and sociodemographic characteristics and behavioral risk factors among Kenyans using a

nationally representative sample. The use of the WHO STEPWise survey is a strength as the methods and survey instruments have been found to be reliable (Bonita et al., 2003; Janghorbani et al., 2007; Riley et al., 2016).

9. Conclusion

To the best of the researchers' knowledge, this study provides one of the first national examinations of factors associated with overweight or obesity among both men and women in Kenya and begins to provide directions laying the foundation of the scope of overweight and obesity in Kenya. This study showed that almost a third of Kenyan adults have overweight or obesity. The results of this study compliment earlier studies showing high prevalence of overweight or obesity among women, wealthy individuals, older individuals, and those living in urban areas in Kenya. This study strengthens the evidence with a nationally representative study. One of the more significant findings to emerge from this study is that alcohol consumption and adequate intake of fruits and vegetables were not significantly associated with likelihood of having overweight or obesity. These findings lay the groundwork for future research into better ascertaining health behaviors associated with overweight or obesity in Kenya. For example, a limitation for this study is the use of self-reported behavioral measures. behavioral studies utilizing objectively measured physical activity and food intake may expand understanding of behavioral factors associated with overweight and obesity. Notwithstanding this limitation in using self-reported measures, the study certainly adds to the understanding of behavior associated with having overweight or obesity by using measures that are validated and well utilized in the literature. The findings from this study can be used to develop targeted and tailored interventions for groups with higher likelihood of having overweight or obesity. Another important practical implication is that interventions may need to move beyond education as a tool for prevention.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix

Appendix. Prevalence of Overweight or obesity by region, World Health Organization (WHO) Kenya STEPwise Survey, 2015.

Region/ County	Not Overweight or ObesePercent (95% CI)	Overweight or ObesePercent (95% CI)	p-value
Rift Valley	77.6 (71.11, 82.98)	22.4 (17.02, 28.89)	0.051
Baringo	89.04 (76.43, 95.32)	10.96 (4.68, 23.57)	0.011
Bomet	93.86 (88.22, 96.89)	6.14 (3.11, 11.78)	<0.001
Elgeyo Marakwet	88.61 (78.13, 94.43)	11.39 (5.57, 21.87)	0.004
Kajiado	75.17 (57.55, 87.12)	24.83 (12.88, 42.45)	0.696
Kericho	75.75 (69.42, 81.13)	24.25 (18.87, 30.58)	0.272
Laikipia	76.4 (68.85, 82.59)	23.6 (17.41, 31.15)	0.278
Nakuru	56.12 (47.39, 64.49)	43.88 (35.51, 52.61)	<0.001
Nandi	80.48 (68.58, 88.61)	19.52 (11.39, 31.42)	0.152
Narok	60.53 (36.4, 80.43)	39.47 (19.57, 63.6)	0.289
Samburu	88.91 (72.46, 96.07)	11.09 (3.93, 27.54)	0.037
Trans-nzoia	84.75 (74.2, 91.47)	15.25 (8.53, 25.8)	0.021
Turkana	99.11 (92.42, 99.9)	0.89 (0.1, 7.58)	<0.001
Uasin Gishu	75.98 (63.2, 85.35)	24.02 (14.65, 36.8)	0.513
West Pokot	94.03 (83.6, 97.99)	5.97 (2.01, 16.4)	<0.001
Central	58.03 (51.28, 64.49)	41.97 (35.51, 48.72)	<0.001
Kiambu	55.31 (42.76, 67.21)	44.69 (32.79, 57.24)	0.004
Kirinyaga	68.84 (57.57, 78.25)	31.16 (21.75, 42.43)	0.547
Muranga	53.46 (40.27, 66.19)	46.54 (33.81, 59.73)	0.003
Nyandarua	64.92 (61.31, 68.35)	35.08 (31.65, 38.69)	0.003
Nyeri	56.98 (54.18, 59.74)	43.02 (40.26, 45.82)	<0.001
Coast	73.03 (63.97, 80.51)	26.97 (19.49, 36.03)	0.817
Kilifi	88.24 (81.8, 92.61)	11.76 (7.39, 18.2)	<0.001
Kwale	67.9 (60.36, 74.6)	32.1 (25.4, 39.64)	0.277
Lamu	64.32 (41.37, 82.16)	35.68 (17.84, 58.63)	0.455
Mombasa	60.78 (53.16, 67.91)	39.22 (32.09, 46.84)	0.003
Taita Taveta	76.48 (70.36, 81.66)	23.52 (18.34, 29.64)	0.194
Tana River	84.64 (73.08, 91.79)	15.36 (8.21, 26.92)	0.036
Eastern	75.11 (69.49, 80)	24.89 (20, 30.51)	0.285
Embu	66.88 (63.1, 70.46)	33.12 (29.54, 36.9)	0.03
Isiolo	76.96 (39.51, 94.47)	23.04 (5.53, 60.49)	0.755
Kitui	81.13 (74.29, 86.48)	18.87 (13.52, 25.71)	0.017
Machakos	66.09 (54.71, 75.87)	33.91 (24.13, 45.29)	0.259
Makueni	74.19 (56.68, 86.33)	25.81 (13.67, 43.32)	0.786
Marsabit	91.15 (72.86, 97.53)	8.85 (2.47, 27.14)	0.03
Meru	79.58 (67.61, 87.91)	20.42 (12.09, 32.39)	0.191
Tharaka-nithi	71.93 (58.92, 82.08)	28.07 (17.92, 41.08)	0.983
Nyanza	72.56 (66.85, 77.61)	27.44 (22.39, 33.15)	0.863
Homa Bay	78.98 (70.32, 85.62)	21.02 (14.38, 29.68)	0.116

(continued on next page)

(*continued*)

Region/ County	Not Overweight or ObesePercent (95% CI)	Overweight or ObesePercent (95% CI)	p-value
Kisii	67.77 (55.73, 77.84)	32.23 (22.16, 44.27)	0.438
Kisumu	68.32 (57.81, 77.24)	31.68 (22.76, 42.19)	0.454
Migori	83.27 (67.81, 92.17)	16.73 (7.83, 32.19)	0.13
Nyamira	60.45 (51.14, 69.06)	39.55 (30.94, 48.86)	0.01
Siaya	76.8 (69.47, 82.82)	23.2 (17.18, 30.53)	0.221
Western	75.92 (69.16, 81.59)	24.08 (18.41, 30.84)	0.249
Bungoma	73.11 (58.39, 84.05)	26.89 (15.95, 41.61)	0.875
Busia	79.21 (72.5, 84.63)	20.79 (15.37, 27.5)	0.052
Kakamega	73.14 (62.46, 81.68)	26.86 (18.32, 37.54)	0.829
Vihiga	87.44 (81.01, 91.91)	12.56 (8.09, 18.99)	<0.001
North Eastern	84.24 (76.51, 89.77)	15.76 (10.23, 23.49)	0.004
Garissa	87.04 (58.87, 96.92)	12.96 (3.08, 41.13)	0.205
Mandera	82.16 (73.44, 88.46)	17.84 (11.54, 26.56)	0.03
Wajir	84.12 (78.16, 88.69)	15.88 (11.31, 21.84)	<0.001
Nairobi	62.23 (49.44, 73.53)	37.77 (26.47, 50.56)	0.061

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