

Street Food Consumption and Overweight and Obesity Among Adults in Tbilisi, Georgia: A Cross-Sectional Survey, 2024

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ABSTRACT

Background: Street food (SF) is widely consumed in Tbilisi and often energy-dense. However, its role in the development of overweight and obesity among urban adults remains unclear.

Objectives: We aimed to describe street-food consumption patterns among adults and assess whether higher consumption frequency is associated with elevated body mass index (BMI).

Methods: A cross-sectional survey was conducted in 2024 among SF consumers at randomly selected vendor sites across Tbilisi (n=860). Overweight or obesity (BMI ≥ 25 kg/m²) was calculated from self-reported height and weight. Key exposures included street-food consumption frequency (≥ 2 vs. < 2 times/week), food diversity (≥ 3 vs. ≤ 2 categories/month), and sugar-sweetened beverage (SSB) intake (Never, Rare, Occasional, Regular). Perceived health risks of street-food consumption were assessed using a five-item scale (range=5-25). Additional covariates included age, sex, socioeconomic status (SES), physical activity, and sedentary time. Associations were examined using chi-square tests, t-tests, and binary logistic regression.

Results: The mean age of participants was 38.8 (SD = 12.8) years, and 60.6% were male. Overall, 36.6% of participants had a BMI of 25 kg/m² or greater. High-frequency SF consumers (≥ 2 times/week) had 3.65 times higher odds of being overweight/obese than those consuming less often (OR=3.65, 95% CI: 2.44-5.45, $p < 0.05$). SSB intake showed an inverse association versus non-consumers (e.g., Regular ≥ 4 /wk.: OR = 0.58; 95% CI, 0.38-0.88; $p = 0.01$). Male sex was associated with an increased risk (OR=1.99; 95% CI, 1.45-2.72); however, age, SF diversity, perceived risk, and physical activity were not.

Conclusions: Frequent consumption of street food and sugar-sweetened beverages is a modifiable risk factor for overweight and obesity in Tbilisi. Interventions that reduce consumption frequency and promote healthier beverage options could meaningfully support obesity prevention in urban Georgia.

Keywords: Cross-sectional study; Georgia; obesity; overweight; street Food; sugar-sweetened beverages; Tbilisi.

BACKGROUND

Street food (SF) plays a significant role in urban diets worldwide by offering affordable, convenient, and culturally familiar meals.^{1,2} In Tbilisi, Georgia, people frequently consume traditional dishes such as khachapuri, lobiani, and kubdari, alongside modern fast-food options.³ Despite their popularity, the nutritional quality of these foods and their contribution to diet-related health problems remain poorly described.

At the same time, obesity and other non-communicable diseases (NCDs) are increasing in urban populations. Street foods are often energy-dense and high in saturated fat, sugar, sodium, and trans fatty acids (TFAs) - nutrients linked to weight gain, metabolic disorders, and cardiovascular disease.^{4,5} The World Health Organization (WHO) highlights industrial TFAs as an important, modifiable dietary risk factor and recommends minimizing intake to about 2.2 g per day.⁶ However, in the WHO European Region, reducing TFA exposure remains challenging, especially in areas where informal and small-scale food vendors are common. Georgia introduced limits on TFAs in 2022 (Government Decree N262, 2016; N353, 2017), but enforcement in informal settings and small bakeries has been limited. Data from the FEEDcities project showed that a single portion of some popular street foods in Tbilisi can contain TFAs equivalent to nearly half of the WHO's recommended daily maximum, suggesting that habitual consumption of multiple items could lead to substantial exposure.⁷

Obesity rates are high among the Georgian population, posing a growing public health concern.⁸ However, the specific role of SF consumption patterns in these trends remains poorly understood.

To address this gap, we conducted a cross-sectional consumer survey in Tbilisi in 2024 to (i) describe the frequency and variety of SF consumption among adults, and (ii) examine whether SF consumption is associated with overweight and obesity. By focusing on consumer behavior at the point of purchase, this study aims to inform targeted, practical interventions to promote healthier SF environments.

METHODS

We used the FEEDcities 2021 mapping of SF vendors (n=371) as the sampling frame for the present study.⁹ From that frame, 120 vendor sites were randomly selected to serve as the vendor list for 2024 fieldwork. To ensure probability proportional to size (PPS) sampling across the city, 100 geographic sampling areas were defined based on district population size, and selected vendors were assigned to these areas. At each assigned vendor, fieldworkers recruited approximately ten adult consumers using convenience sampling. Eligibility criteria included adults aged 18 years or older who had resided in Tbilisi for at least one year. Data were collected through structured, face-to-face interviews. Verbal



informed consent was obtained from all participants. Of 900 individuals approached, 860 provided complete and valid data after cleaning.

Study variables

The outcome variable was overweight or obesity, defined as a Body Mass Index (BMI) $> 25 \text{ kg/m}^2$, calculated from self-reported weight and height. WHO classification standards were applied, categorizing individuals as normal weight ($18.5\text{--}24.9 \text{ kg/m}^2$), overweight ($25.0\text{--}29.9 \text{ kg/m}^2$), and obese ($\geq 30.0 \text{ kg/m}^2$).¹⁰ Because underweight cases were rare, these individuals were grouped with the normal-weight category for analysis. For regression models, BMI was dichotomized into $<25 \text{ kg/m}^2$ (normal weight) and $\geq 25 \text{ kg/m}^2$ (overweight or obese). The key exposure variables included SF consumption behaviors, lifestyle factors, health-related perceptions, sociodemographic characteristics, and health status.

Both frequency and diversity assessed SF consumption. Frequency was based on self-reported weekly consumption. Participants were categorized as low-frequency consumers (<2 times per week) or high-frequency consumers (≥ 2 times per week). Diversity of SF consumption was measured as the number of distinct food categories consumed in the past month. For this purpose, SF were classified into five major groups based on predominant ingredients and preparation methods. These categories were developed in the absence of a standardized national food composition database for SF in Georgia and were therefore informed by culinary characteristics. The groups included: (a) Khachapuri, traditional Georgian cheese-filled bread, represented by four regional variations (Megruli, Imeruli, Guruli, and layered khachapuri); (b) Lobiani, Georgian bean-filled bread, available in two types (traditional lobiani and lobiani with ham); (c) Sweet pastries, such as baklava, cream cake, loose cake or muffin, sweet puff pastry, and sweet buns; (d) Savory baked goods, including kubdari (a meat-filled bread), savory meat pie, savory potato pie, and chebureki (a deep-fried pastry filled with meat); and (e) Non-traditional fast foods, such as hamburgers, hotdogs, shawarma, and pizza. Participants consuming items from zero to two of these categories were classified as low-diversity consumers, whereas those consuming from three to five categories were considered high-diversity consumers.

Sugar-sweetened beverage (SSB) intake was analyzed as part of consumption behaviors. Participants were classified as rare consumers (<1 time per week), occasional consumers ($1\text{--}3$ times per week), or regular consumers (≥ 4 times per week).

Physical activity and sedentary behavior were self-reported as minutes per day and analyzed as continuous variables (minutes/day). Physical activity was represented by the minutes spent engaging in moderate-to-vigorous activity (e.g., walking, running, cycling). In contrast, sedentary behavior was represented by the minutes spent sitting or lying awake (excluding sleep).

Perceived health risks of SF were measured using five 5-point Likert items addressing perceived fat quantity, fat quality, reheated-oil use, disease risk, and weight gain. Items were coded from 1 to 5 and reverse-scored where appropriate so that higher values indicated greater perceived risk. Item scores were summed to produce a total perception score (range 5–25). For descriptive analysis, scores were grouped into three categories: low (<15), moderate (15–19), and high (≥ 20). For multivariable models, the score was entered as a continuous covariate. The internal consistency of the scale was evaluated using Cronbach's α ($\alpha \geq 0.70$ considered acceptable).

Health status variables included self-reported diagnoses of chronic conditions. A composite "any chronic condition" indicator was created (Yes/No), coded "Yes" if participants reported at least one of the following: hypertension, high cholesterol, diabetes, heart disease, or cancer (self-reported diagnoses). Sociodemographic characteristics were assessed using indicators of education, income, and employment. To strengthen analyses, a composite socioeconomic status (SES) variable was created by combining education and income. Education was categorized as low (no formal schooling, refused, or primary), middle (secondary or vocational), and high (college or university). Income was grouped as low (<500 GEL or none), middle (500–1,499 GEL), and high ($\geq 1,500$ GEL). Each variable was coded 1–3 and summed (range 2–6) to construct an SES score. SES was then classified as low (2–3), mid (4), and high (5–6). Participants missing either education or income were coded as missing on SES.

Data analysis

Descriptive statistics were computed for all variables. Means and standard deviations (SD) were reported for continuous variables, while frequencies and percentages were presented for categorical variables. To identify factors associated with overweight and obesity, several statistical tests were applied. Associations between categorical predictors and overweight/obesity (BMI ≥ 25 vs. $<25 \text{ kg/m}^2$) were evaluated using chi-square tests. For continuous predictors (age, physical activity, and sedentary time), mean differences by BMI category were assessed using independent-samples t-tests.

To determine variables independently associated with overweight/obesity, binary logistic regression analysis was conducted. Regression coefficients (B) represented the change in the log-odds of being overweight/obese for each predictor. At the same time, odds ratios (Exp(B)) indicated how the odds of the outcome changed with a one-unit increase in the predictor variable. Statistical significance was defined as $p < 0.05$. Analyses were conducted in SPSS Version 16.0 and Microsoft Excel 2016.

RESULTS

Of the 900 adults approached, 860 were analyzed, with a mean age of 38.8 ± 12.8 years and a male-to-female ratio of 60.6%. Overall, 36.5% of participants were classified as overweight or obese ($\text{BMI} \geq 25 \text{ kg/m}^2$). Overweight and obesity were more common among men than women (43.6% vs. 26.0%; $p < 0.05$). Prevalence increased with higher socioeconomic status (SES) ($p < 0.05$) and with a higher frequency of street food consumption (42.7% vs. 18.8%; $p < 0.001$). SSB consumption also showed a positive gradient ($p < 0.05$), whereas diversity, perceptions, and chronic disease status did not (all $p > 0.05$) (Tab.1).

TABLE 1. Sample characteristics and overweight/obesity among street-food consumers (Chi-square tests for categorical variables; independent-samples t-tests for continuous variables)

Variables		Total (N)	Overweight/obese (%)	P value
Sex	Female	339	26.0	<0.05
	Male	521	43.6	
Socioeconomic status	High	337	41.8	0.02
	Low	216	30.6	
	Mid	288	34.0	
Street food frequency (per week)	< 2/wk	218	18.8	<0.05
	≥ 2 /wk	642	42.7	
sugar-sweetened beverage (per week)	1–3/wk	201	37.3	<0.05
	Rare/never	374	30.2	
	≥ 4 /wk	285	44.6	
Diversity of the street food	≤ 2 categories	184	35.3	0.74
	≥ 3 categories	676	37.0	
Health risk perception of street food	Low	152	32.9	0.18
	Moderate	433	39.5	
	High	275	33.8	
Chronic condition (yes/no)	≥ 1 chronic condition	155	39.4	0.47

Overweight and obese participants were, on average, older than those of normal weight (40.7 vs. 37.7 years; $p < 0.05$). No significant differences were observed in mean daily physical activity or sedentary time among BMI categories (all $p > 0.50$) (Tab.2).

TABLE 2. Comparison of selected variables by BMI category among SF consumers (independent samples t-tests)

Variable	Weight status	N	Mean (SD)	t value	p value
Age (years)	Normal weight	546	37.7 (12.7)	-3.36	<0.05
	Overweight/obese	314	40.7 (12.7)		
Physical activity (min/day)	Normal weight	546	228.4 (95.9)	-0.56	0.57
	Overweight/obese	314	232.5 (113.2)		
Sedentary time (min/day)	Normal weight	546	190.5 (105.9)	-0.13	0.89
	Overweight/obese	314	191.6 (133.0)		

In multivariable binary logistic regression (Tab.3), SF consumption frequency was significantly associated with overweight and obesity: adults consuming street food ≥ 2 times per week had 3.5 times higher odds of being overweight or obese compared with those consuming it less often ($\text{OR} = 3.50$; 95% CI, 2.37-5.18; $p < 0.05$).

TABLE 3. Factors associated with overweight and obesity among street food consumers (binary logistic regression)

Variables	Coefficient B	Odds Ratio (Exp(B))	95% CI (Lower-upper)	p value
Age (per year)	0.03	1.03	1.01-1.04	<0.05
Sex (Male vs. Female)	0.69	1.99	1.45-2.72	<0.05
SES (Low vs. High)	0.73	2.07	0.77-5.58	0.15
SES (Mid vs. High)	0.39	1.48	1.05-2.11	0.03
SF frequency (≥ 2 vs. < 2 /wk)	1.25	3.50	2.37-5.18	<0.05
SF diversity (≥ 3 vs. ≤ 2 categories)	-0.12	0.89	0.61-1.29	0.53
Perceptions score (continuous)	0.01	1.01	0.96-1.06	0.71
SSB per week (Occasional vs. Never)	-1.02	0.36	0.24-0.56	<0.05
SSB per week (Rare vs. Never)	-0.43	0.65	0.43-0.96	0.03
SSB per week (Regular vs. Never)	-0.55	0.58	0.38-0.88	0.01
Physical activity (per 10 min/day)	0.01	1	0.99-1.00	0.47
Sedentary time (per 30 min/day)	0	1	0.99-1.00	0.86
Chronic disease (yes/no)	0.20	1.22	0.83-1.52	0.31

SSB intake showed an inverse association: compared with rare consumers, occasional consumers ($\text{OR} = 0.36$; 95% CI, 0.24-0.56) and regular consumers (≥ 4 /week; $\text{OR} = 0.58$; 95% CI, 0.38-0.88) had lower odds of being overweight or obese.

Neither SF diversity nor perceived health-risk scores were significantly associated with overweight or obesity. Among covariates, male sex ($\text{OR} = 1.99$; 95% CI, 1.45–2.72; $p < 0.05$) and

mid-level SES (vs. high SES; OR=1.48; 95% CI, 1.05-2.11; $p=0.03$) were significant predictors.

Age, physical activity, sedentary time, and chronic disease were not associated with overweight or obesity.

DISCUSSION

Our study found that the frequency of street food consumption was significantly associated with overweight and obesity among adults in Tbilisi. Individuals who consumed SF 2 or more times per week had approximately 3.5 times the odds of a BMI ≥ 25 kg/m² compared with those who consumed it less frequently. This finding indicates that repeated exposure to energy-dense, ready-to-eat foods can meaningfully increase the risk of excessive body weight. In contrast, food-type diversity and perceived health-risk scores related to SF consumption were not independently associated with BMI.

These patterns align with previous evidence linking frequent exposure to energy-dense, ready-to-eat foods with weight gain and metabolic disorders.^{13,14} In Tbilisi, everyday SF items such as khachapuri variants, lobiani, savory pastries, chebureki, and shawarma are typically high in energy and prepared with lower-quality fats. Portions often exceed those of a light meal.⁹ Regular consumption of such foods likely increases total energy intake, even when the specific items vary. The local context, with ongoing concerns about industrial trans-fatty acids and saturated fats in bakery fats, despite policy efforts, adds biological plausibility to these findings.

The inverse association observed for sugar-sweetened beverage consumption, although unexpected, may reflect behavioral changes following weight gain or a chronic disease diagnosis. Liquid calories are generally poorly compensated for at subsequent meals and are usually associated with weight gain.¹⁵⁻¹⁷ However, in our sample, adults who were already overweight or obese may have reduced or avoided SSBs, which could have contributed to the observed pattern. This finding underscores the importance of cautious interpretation and the value of longitudinal research in clarifying directionality.

Diversity in street food consumption and risk perception were not associated with overweight or obesity. The diversity measure captured only the number of food categories consumed, without considering portion size or nutritional quality. Consequently, a participant could appear “diverse” while consistently choosing high-energy foods. Moreover, diversity was assessed over a month, whereas frequency was assessed weekly, which may have weakened the observed association. Regarding perceptions, this finding reflects the well-documented gap between knowledge and behavior:

awareness that street food is risky does not necessarily translate into healthier choices when factors such as taste, price, convenience, and social influence are more influential.

Demographic patterns observed in this study were consistent with national data.^{18,19} Men had higher odds of overweight and obesity, possibly due to larger portion sizes, more frequent purchases, and biological differences in visceral fat accumulation. Age was not statistically significant, suggesting limited predictive importance. Participants with mid-level socioeconomic status (SES) were more likely to be overweight or obese than those with high SES. This may reflect complex dietary trade-offs: while high-SES groups can afford healthier alternatives, mid-SES individuals may depend more on affordable yet energy-dense street options.

No independent associations were observed between overweight or obesity and self-reported physical activity or sedentary time. Self-reported daily minutes of physical activity and sitting are prone to measurement error, and dietary factors may explain a greater share of BMI variation in this population. Notably, the strong effects of SF frequency and SSB intake persisted despite potential nondifferential misclassification (e.g., recall bias or self-reported weight), which typically biases results toward the null. Therefore, the true associations may be even stronger than estimated.

Strengths and limitations

The key strengths of this study include the city-wide sampling of vendors, on-site recruitment of actual consumers at the point of purchase, and the use of pre-specified, theory-driven exposure constructs (weekly frequency and monthly diversity). However, several limitations must be noted. The cross-sectional design precludes causal inference. Self-reported height and weight may bias BMI classification. Recall and social-desirability biases may have influenced food-frequency responses. The limited variation in diversity scores, with most participants reporting only three categories, reduced the ability to detect a gradient. Finally, residual confounding from unmeasured factors such as total energy intake, alcohol use, smoking, or detailed SES indicators cannot be excluded.

CONCLUSIONS

In this urban setting, a statistically significant association exists between the frequency of street food and drink consumption and the prevalence of overweight/obesity. Targeted changes to purchase frequency, beverage defaults, and fat quality/portion norms at vendors are realistic next steps for reducing obesity risk in Tbilisi.

Our findings suggest several practical ways to improve the street-food environment in cities. Encouraging people to purchase street food less frequently and making lower-calorie options more readily available could help reduce excess calorie intake. Efforts to improve food choices should also include actions to limit sugary drink consumption, such as implementing more transparent labels and adjusting prices. Given the prevalence of street food purchases, vendor training, supply chain support for healthier oils, and simple consumer reminders (e.g., visible water or unsweetened tea alternatives) may be efficient first steps.

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