World Health Organization

European Region

FEEDcities project

The food environment in cities in eastern Europe and central Asia – Georgia

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Abstract

This technical report presents results from the FEEDcities Project in eastern Europe and central Asia. A cross-sectional survey was conducted in Tbilisi, Georgia, between November and December 2021 and aimed to evaluate the local urban street food environment. It characterized vending sites, the food offered and the nutritional composition of both commercial and homemade street foods available in this setting. The policy implications of the findings are outlined.

Keywords

FAST FOODS
FOOD ANALYSIS
GEORGIA (REPUBLIC)
POTASSIUM
SODIUM
SUGARS
TRANS FATTY ACIDS

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Contents

Acknowledgements

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Abbreviations

FAO	Food and Agriculture Organization of the United Nations
GDP	gross domestic product
NCDs	noncommunicable diseases
TFA	trans-fatty acid

Glossary

Baklava
Sweet pastry dessert made of filo layers, chopped nuts and sugar, syrup or honey.

Bread lavashi
Flatbread made with flour, water, yeast and salt.

Chebureki
Fried savoury pastry, generally filled with ground or minced meat and, onions, garlic, salt and other ingredients.

Khachapuri
Traditional cheese-filled bread. The bread usually is leavened and allowed to rise, moulded into various shapes and then filled in the centre with cheese. There are several types of Khachapuri, such as Imeruli, Megruli, Adjaruli or Layered Khachapuri, with different types of bread and/or ingredients together with cheese, eggs and others.

Kubdari
Traditional filled bread dish. The bread is leavened and allowed to rise. The filling contains pieces of meat such as beef and sometimes with mixture of beef and pork, Georgian spices and onions.

Kefir
Fermented milk drink made with a yeast or bacterial fermentation starter of *kefir* grains.

Matsoni
Traditional fermented milk drink made from cow's milk (essentially); can also be made from goat, sheep, buffalo milk or a mix of these, as well as a bacterial fermentation by specific bacterial culture taken from previous productions. Similar to yogurt, it has a savoury/sour taste.

Shawarma
Dish made of shawarma meat (in Georgia usually pork, chicken or their mixture, sometimes with lamb or mutton), chopped or shredded vegetables, pickles and assorted condiments in a flour wrap.

Executive summary

This report provides information on the street food environment of urban Tbilisi, the capital city of Georgia, assessed through a standardized methodology. It provides a valuable characterization of street food offered in this setting, highlighting the need to strengthen policy efforts in order to improve this food environment.

The Food and Agriculture Organization of the United Nations (FAO) and WHO define street food as "ready-to-eat foods and beverages prepared and/or sold by vendors and hawkers particularly in streets and other similar places". In many locations, particularly in cities from low- and middle-income countries, street food constitutes an important daily food source for many dwellers, mainly due to its accessibility, affordability and diversity of options. Nevertheless, it frequently comprises foods that are energy dense and rich in fat, sugar and salt. Despite these concerns, previous work has mainly explored issues related to street food's hygiene and safety, focusing less on the description of available foods and their nutritional composition.

The main objective of the FEEDcities project is to characterize the street food environment in cities in eastern Europe and central Asia. This study also continues providing evidence to support some of the objectives of the Action Plan for the Prevention and Control of Noncommunicable Diseases in the WHO European Region 2016–2025, such as creating healthy food and drink environments and increasing surveillance, monitoring, evaluation and research.

The present report describes the characteristics of vending sites, the foods and beverages they offer and the nutritional composition (in particular, the sodium, potassium, trans-fatty acid (TFA) and free sugars content) of the most commonly available foods in Tbilisi. The findings from this work are expected to contribute to the implementation of public health strategies aimed at improving this food environment and, more broadly, to the development of population-based interventions to reduce intake of TFAs, sodium and free sugars.

Between November and December 2021, all eligible street food vending sites in Tbilisi were identified and mapped. These sites were widely distributed across the city. As such, a sample of vending sites was selected through simple random sampling. These sites were situated in five city districts: Didube-Chugureti, Gldani-Nadzaladevi, Isani-Samgori, Saburtalo and Vake. Vending sites selling exclusively unprepared fresh fruit were not included in the study.

A total of 120 street food vendors were interviewed to assess the characteristics of their vending sites and the types of ready-to-eat foods and beverages sold. In order to characterize the street food offered, foods were classified as homemade (cooked and/or prepared at home or on the street, even with industrial ingredients), industrial (produced by the food industry and sold with no further preparation) or fruits (whether fresh or dried and prepared or unprepared), while beverages were grouped into alcoholic beverages, coffee, energy drinks, fresh fruit juice, juice, lemonade, milk, soft drinks, tea, fermented beverages, yoghurt and water.

The vendors interviewed were primarily women (85.0%) and employees of the businesses (80.0%). All selected vending sites were stationary, with kiosks being the most frequent outlet type (82.5%); the remainder were stands, stalls or booths. All vendors reported that their site operated every day of the week and throughout the year, regardless of weather.

A wide range of food options was available in this food environment, reflecting a rich street food culture. Food was sold at 98.3% of vending sites (kiosks: 98.0%; stands, stalls or booths: 100.0%), while beverages were available at 78.3% (kiosks: 81.8%; stands, stalls or booths: 61.9%). No fruit was available at the vending sites assessed. Among the vending sites selling food, the majority sold only homemade food (80.5%), the remaining selling exclusively industrial foods (19.5%). Regarding beverages, the most commonly available were soft drinks (94.7% of vending sites selling beverages), water (89.4%) and energy drinks (64.9%). Juice (59.6%) and coffee (41.5%) were also frequently found. In general, the results by district and physical setup were similar across the districts, with only small differences observed.

Following evaluation of the street food vending sites, food samples of the most commonly available foods in this setting were collected. Random and systematic sampling procedures were used to select the vending sites from which these foods would be sampled. A total of 119 food samples were collected, which represented up to four samples of each of the 30 most common foods (20 homemade and 10 industrial).

The contents of free sugars, TFA, sodium and potassium varied considerably among the foods analysed. However, high contents of these nutrients were frequently observed. The highest mean levels of free sugars per serving were found in industrial chocolate (40.1 g) and homemade bakery products such as cream cake (31.0 g), loose cake (30.8 g), *baklava* (29.1 g) and buns (28.0 g), all of which surpass 50% of the maximum recommended free sugars daily intake for an average adult consuming 2000 kcal. The highest amount of TFA per serving was found mainly among homemade savoury pastries, namely *khachapuri* (means ranging from 0.66 g to 0.99 g, depending on the filling) and *chebureki* (0.48 g), although a high mean content was also observed in a homemade sandwich, *shawarma* (0.46 g). One serving of these foods corresponded, on average, to 20–45% of the recommended maximum daily intake of TFAs, and a considerable number of these foods surpassed the maximum WHO recommendation for TFAs in food (2 g TFA/100 g of total fat). Regarding sodium, the richest sources were also the homemade options: one serving of *shawarma* provided, on average, 2098 mg of sodium, surpassing the recommended maximum daily intake for this nutrient, whereas *khachapuri* filled with *megruli (*1182 mg) and filled with *guruli* (1048 mg) surpassed half of this recommendation in a single portion. The overall potassium content of the street foods analysed was generally low. The highest mean content of this nutrient was also found in homemade foods such as *shawarma* (992 mg), ham (479 mg) and traditional *lobiani* (477 mg), representing 10.2–28.3% of the minimum recommended daily intake of potassium.

These results suggest that there is a high potential for improving the nutritional composition of street food available in Tbilisi, with particular attention to the reduction of free sugars, TFA and sodium. Homemade foods were frequently rich sources of these nutrients, highlighting the importance of strategies aiming to enhance the culinary practices and ingredients used by vendors while preserving traditional gastronomy. The low potassium content in the street foods analysed reflects the scarce inclusion of vegetables, legumes and fruits. Increasing the availability of these ingredients could enhance the access of street food consumers to these nutrient-dense, healthy food options. The types of beverages offered in this food environment could also be improved, as the wide availability and prevalence of sugary soft drinks and energy drinks is a source of concern.

Lowering the amount of free sugars, salt and TFAs in foods sold by street vendors in Tbilisi may need a multifaceted approach, involving nutrition education of both vendors and consumers, regulations for the achievement of salt, free sugars and TFA reduction targets in industrially produced foods, price policies to increase the affordability of healthier ingredients and improvement of food labels in packaged foods, among other measures. These strategies could be integrated within existing national policies and should be aligned with regular monitoring. Establishing partnerships with key stakeholders is also essential from a perspective of improving the overall food system.

Introduction

Georgia is located at the intersection of Europe and western Asia, specifically in the Caucasus region, bounded by the Black Sea to the west. It is an upper-middle-income country with an annual gross domestic product (GDP) per capita of US$ 5023.3 as at 2021. The country has been undergoing consistent development over the decade 2011-2021, reflected by an average growth in GDP growth of 4% per year in that period. *(1)*. The population numbers around 3.7 million people, with 1.2 million concentrated in Tbilisi, the largest and capital city of the country *(2)*. The poverty rate, which reflects the threshold for a person's minimum needs for nutrition, clothing and shelter, has decreased noticeably since 2000, from 22.9% to 5.8% in 2020. Approximately 60% of the population lives in urban areas. The country is undergoing a stagnation in the rate of population growth (-0.4% in 2021). In 2021 the country's net migration (the difference between the number of inward and outward migrants) was negative (-2734 individuals) *(1)*, approximately 9.7% of the population was aged under 15 years and 9.6% was aged 65 years or above *(2)*. Life expectancy at birth is estimated at 73 years *(1)*.

Noncommunicable diseases (NCDs) are the leading cause of death in Georgia. Cardiovascular diseases account for 60% of all deaths, followed by cancer (17%) and other NCDs such as digestive diseases, neurological disorders, diabetes and chronic respiratory diseases (15%) *(3)*. Findings from the most recent (2016) STEPwise approach to NCDs risk factor surveillance (STEPS) survey in the country showed that the prevalence of overweight and obesity among the adult (> 18 years) Georgian population is 64.6% with prevalence of overweight (including obesity) at 65.5% among men and 63.8% among women. Obesity affects 33.2% of the total adult population distributed at 30.2% among men and 36.0% women. Regarding alcohol consumption, 39.0% of the population were current alcohol drinkers,[1] and 18.3% of the total population exhibited heavy drinking habits. In addition, 63.0% of the population in Georgia consumed less than five servings of fruit and/or vegetables per day. This survey showed that more than one fourth of the population always or often adds salt or salty sauces to a dish before or after trying it and that average daily salt consumption was 8.5 g among the adult population (9.7 g among men and 7.4 g among women) *(5)*. In a study of the prevalence of childhood obesity and behavioural and environmental factors among primary school children (7–9 years of age) in Georgia conducted in 2018–2020, the prevalence of overweight (including obesity) was approximately 30% *(6)*.

Eastern European countries in the WHO European Region have experienced a nutritional transition in recent decades as a result of growing urbanization and the globalization of the processed food supply chain. The most prominent changes in the Region specifically include decreasing consumption of cereals, roots and tubers and higher consumption of animal products, as well as higher availability of sugar, sweeteners and vegetable oils *(7)*. More generally, the nutritional transition is characterized by lower consumption of foods rich in fibre such as legumes, fruits, vegetables and whole grains, and more frequent intake of processed foods likely to be energy dense and rich in fats, sugar and salt *(8)*, which are known to be associated with weight gain and a greater frequency of NCDs.

In particular, there is consistent evidence that trans-fatty acid (TFA) and sodium in industrially produced foods increase the risk of cardiovascular diseases *(9)*. WHO is advocating for complete elimination of TFA from the global food supply *(9,10)* and public health authorities in several countries are initiating effective bans or regulations on their use *(11)*. WHO has also called for a significant reduction in sodium intake. Most dietary intake of sodium is either from the addition of salt during food preparation and cooking or from processed foods. Salt-reduction initiatives are based on product reformulation, public awareness and clear rules for product labelling *(12)*. WHO recommends a level of ≤ 2000 mg of sodium intake per day for adults, corresponding to 5 g of salt (sodium chloride) per day, in order to reduce blood pressure and the risk of cardiovascular diseases *(13)*. Nevertheless, in most countries for which recent data are available, dietary sodium intake is much higher *(14)*.

1 In the STEPS questionnaire, a "current alcohol drinker" was defined based on alcohol consumption in the previous month.

For potassium, another key nutrient which is inversely associated with blood pressure, WHO recommends a minimum daily intake of 3510 mg to reduce the risk of cardiovascular diseases *(13)*.

In addition, high levels of consumption of free sugars are associated with increased risk of overweight, obesity and NCDs, namely diabetes and cardiovascular diseases. To tackle this burden, WHO has issued recommendations to reduce the intake of free sugars throughout the life course to less than 10% of total energy intake in both adults and children (strong recommendation), suggesting the need of further reduction of the intake of free sugars to less than 5% of total energy intake (conditional recommendation) *(16)*. The promotion of a healthy diet is a central strategy to achieve these recommendations *(17)*. Available data from national dietary surveys conducted by WHO European Member States showed that mean adult daily added sugars intakes exceeded 5% of total energy intake *(18)*. Nevertheless, considering the reported information on the intake of added sugar, rather than free sugars, this may lead to an underestimation of free sugars intake,[2] as current evidence suggests *(17)*. Another study which focused on the available data on nutrient intakes for children and adolescents suggested that most children in the WHO European Region, particularly those aged 10 years or over, obtained more than 10% of their total energy intake from added sugars *(19)*.

NCDs are a major threat to the socioeconomic well-being of the Georgian population. While there is political commitment to improve health *(20)* and the food system *(21)* in Georgia, the lack of representative surveys and/or data analysis on nutritional status, dietary habits and food composition is a barrier to setting specific health and nutrition policies *(22)*. Tackling NCDs and associated risk factors is a target of the Georgian formal political agenda. The country has implemented some food and nutrition policies already, such as food-based dietary guidelines, with additional policies either planned or having attempted implementation, the latter particularly related to limiting sodium and industrially produced TFAs in food *(23)*.

The Food and Agriculture Organization of the United Nations (FAO) and WHO define street foods as "ready-to-eat foods and beverages prepared and/or sold by vendors or hawkers, particularly in the streets and other similar places" *(24)*. Street food is a cultural, social and economic phenomenon typical of urban areas where the time dedicated to cooking at home is dramatically reduced *(25)*. Street food may be an important component of the daily diet. It also plays an important community role by providing improved access to food at low cost, protecting traditional foods and diets and providing a source of employment opportunities for citizens. Nevertheless, foods purchased from street vendors may also contribute significantly to excessive intake of energy and some nutrients; however, this aspect has received little attention in recent literature *(26)*. The urban street food environment can generally be expected to reflect the food habits of a population, but can also influence dietary patterns. This highlights the importance of characterizing and monitoring street food offerings in the context of the prevention of NCDs.

Street food in Georgia

Street food trading is a common activity in the Caucasus region. Georgian street food gastronomy is represented by dishes of Georgian cuisine and also to some extent influenced by the cuisines of neighbouring countries or empires that were settled in the region in the past, such as the Ottoman and the Russian empires and, more recently, the Soviet Union *(27)*. Fermented drinks such as *matsoni* are traditional in Georgian gastronomy. Among the most famous local street foods are baked or fried pastry pies filled with cheese, minced meat, vegetables or fruits. Common sweet street foods include an array of traditional cakes and sweets, as well as ice cream and popcorn. Pretzels, nuts and seeds are commonly sold as everyday snacks to be eaten on the go *(28)*. As in other street food environments, although traditional foods are likely to be widely available, foods processed by large-

2 "Free sugars" include monosaccharides and disaccharides added to foods and beverages by the manufacturer, cook or consumer, and sugars naturally present in honey, syrups, fruit juices and fruit juice. "Added sugars" include sugars added to food during food processing, sugars used as sweeteners and sugars from honey and concentrated fruit or vegetable juices. Added sugars do not include naturally occurring sugars, such as sugars in the intact cell walls of fruit and vegetables, or sugars present in milk concentrate (narrower definition) *(17)*.

scale manufacturers are becoming important as ingredients and as final products *(29)*. Common western-style street food products include pizza by the slice, hamburgers, sandwiches, French fries, hot dogs, fruit juices and soft drinks *(28)*.

In some regions of eastern Europe and central Asia where the FEEDcities study has been conducted, street food trading is mostly concentrated in areas of increased economic activity, such as markets or the vicinity of transport hubs. However, in a preliminary field visit to Tbilisi it was observed that street food vending sites were widely spread around the city. Although mobile food vendors can be found, most vendors operate stationary units, usually formal establishments such as kiosks and stands where sweet and savoury pastries are prepared on site. Accordingly, the study methodology was adapted to the local context *(30)*.

Objectives of the study

The main objective of this study was to characterize the street food environment of urban Tbilisi. The specific objectives were to describe the characteristics of selected street food vending sites and the street food offered, and to assess the sodium, potassium, TFA and free sugars contents of ready-to-eat foods.

Methodology

A cross-sectional evaluation of street food vending sites was conducted in Tbilisi during November and December 2021. The study protocol was developed by the University of Porto together with the WHO Regional Office for Europe and was approved by the ethics committees of the Institute of Public Health of the University of Porto. Staff and a consultant from the WHO Regional Office for Europe recruited and trained eight local interviewers (all women). A 5-day training course, held online due to COVID-19 restrictions, comprised lectures, demonstrations and practice interviews with the questionnaire for data collection.

Eligibility criteria

The definition of street food used was that proposed by the FAO and WHO: "ready-to-eat foods and beverages prepared and/or sold by vendors or hawkers particularly in the streets and other similar places" *(16)*, which includes prepared foods such as sandwiches or salads, cooked products such as boiled eggs and traditional foods and raw foods like fruit and nuts intended to be consumed immediately, even if they may be consumed later, at home or at work.

Eligible vending sites were those selling ready-to-eat foods and beverages at any site other than a permanent shop, business or establishment with four permanent walls that did not sell directly to the street, within a predefined perimeter. This included mobile street hawkers and sellers with semi-static or stationary vending units. Vending sites at which exclusively unprepared fresh fruit was sold were not eligible, as large amounts are often bought at these sites for household consumption, which does not comply with the definition of ready-to-eat foods used.

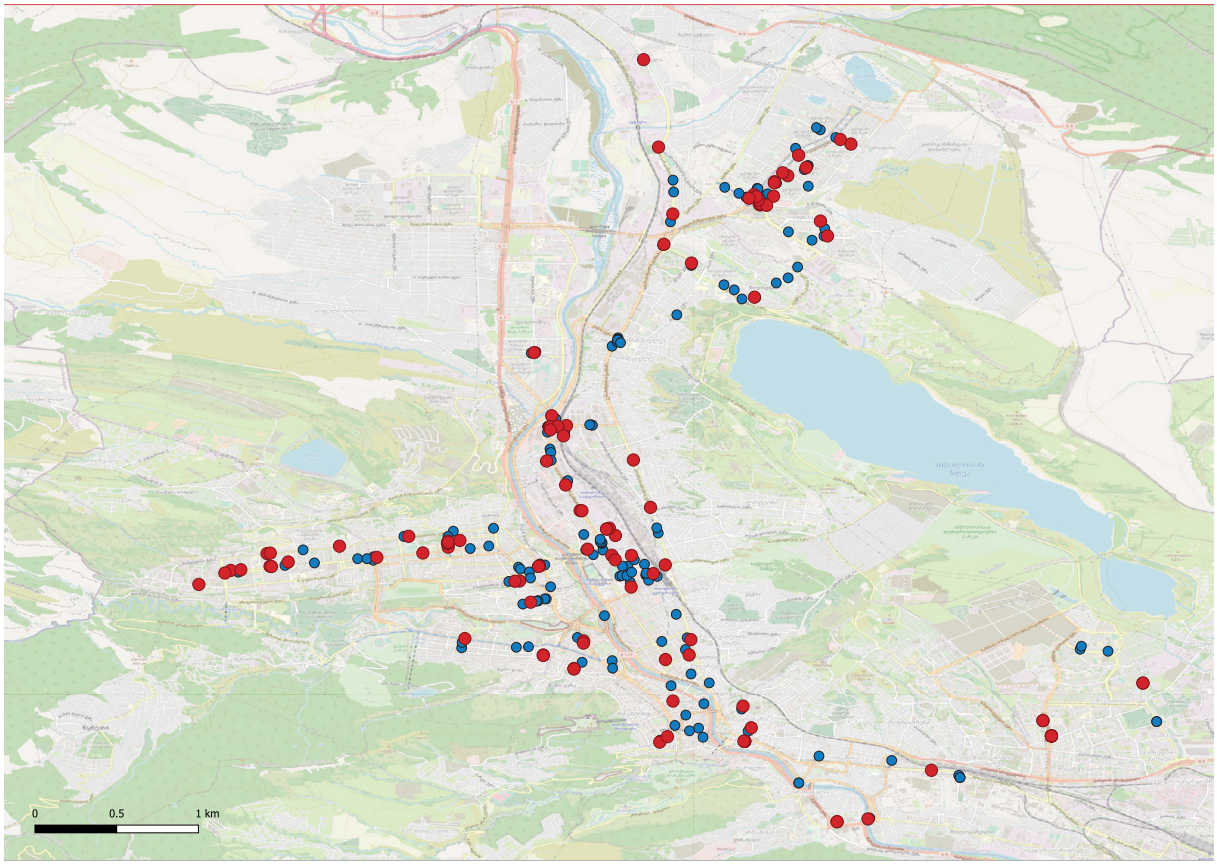
Sampling of vending sites

The vending sites were distributed across Tbilisi. From a prior identification of all available vending sites in the city and respective geographical coordinates (n = 371) conducted by the Georgia National Centre for Disease Control and Public Health, a total of 120 vending sites were selected to be assessed through simple random sampling. Of these, seven were replaced by their geographically closest site from the initial list, as six were closed and the vendor of the last refused to participate in the study.

The vending sites were evaluated on consecutive days, by pairs of field researchers, who were distributed across five Tbilisi districts: Didube-Chugureti, Gldani-Nadzaladevi, Isani-Samgori, Saburtalo and Vake.

After registering the GPS coordinates of each vending site, the field researchers approached the vendor to explain the study objectives and procedures and to ask for their general consent to participate in data collection. The researchers were instructed to answer any questions vendors might have about the purpose of the study and to give them leaflets describing the study. If the vendor agreed, the interviewers administered the structured questionnaire, which took approximately 10 minutes and included questions on food vending activity and the food offered. The vending sites included in the study are shown in Fig. 1.

Fig. 1. Map of the eligible and randomly selected street food vending sites in Tbilisi, Georgia



Vending sites: Randomly selected/assessed Eligible but not selected

To create the maps, QGIS, a Free and Open Source Geographic Information System, has been utilized. This tool leverages data from OpenStreetMap under its license, which permits free use

Source: FEED Cities, Openstretmap 1:45 000

In order to avoid interviewing the same vendor twice and to facilitate recognition of vendors who had already been approached, a sticker with the logo of the research project was attached to the vending site at the end of the interview, with the vendors' agreement.

Characterization of vending sites and food offered

Data were collected by direct observation and face-to-face interviews with vendors who agreed to participate, and included characteristics of the vendors (sex and ownership of the business), the vending site (mobile or stationary), the physical setup of stationary vending sites (e.g. stand, kiosk) and activity (e.g. working days, number of employees, access to clean water and electricity).

Data on the foods offered included the type of food product, size of portion, preparation and packaging. Foods were classified as homemade (cooked and/or prepared at home or on the street, even with industrial ingredients), industrial (produced by the food industry and sold with no further preparation) or fruits (whether fresh or dried, and prepared or unprepared). Beverages were classified into: alcoholic beverages, coffee, energy drinks, fresh fruit juice, lemonade, milk, other juice, soft drinks, tea, fermented beverages (*matsoni* and *kephir*), water and yoghurt.

Selection and collection of food samples

After the street food vending sites had been characterized according to the food they offered, all foods and beverages were ranked by frequency. The twenty most frequently available homemade foods and the ten most frequently available industrial foods for which the nutritional composition was unknown were selected for chemical analysis.

The approach for food sample collection started by grouping the selected homemade foods into sets of three or four foods (A, B, C, D, E and F) and the industrial foods into sets of two or three foods (G, H, I and J) (Table 1). The framework guiding food sampling per day is represented in Table 2. The purpose was to collect one sample of each of the homemade and industrial sets predefined for each day, during seven week days. Each day, approximately 15–20 samples of different foods were collected, until 120 samples had been accrued.

Table 1. Definition of food sample sets in Tbilisi

Homemade food	Set	Industrial food	Set
1	A	1	G
2		2	
3		3	H
4		4	
5	B	5	
6		6	I
7		7	
8	C	8	
9		9	J
10		10	
11	D		
12			
13			
14	E		
15			
16			
17	F		
18			
19			
20			

Table 2. Framework for guiding food sampling from street food vending sites in Tbilisi, per day

Day	Homemade food				Industrial food		
1	A	B	C	–	G	H	–
2	D	E	F	A	I	J	–
3	B	C	D	E	G	H	–
4	F	A	B	–	I	J	G
5	C	D	E	F	H	I	–
6	D	E	F	–	J	G	H
7	A	B	C	–	I	J	–

From the characterization of street food offered in Tbilisi, it was observed that not all vending sites sold all of the 30 most commonly available street foods that had been selected. As such, a random procedure for selecting the vending sites at which each food sample would be collected was further established.

1. For each of the twenty homemade and ten industrial foods, a list of all the vending sites selling the item (with the respective geographical coordinates) was created.
2. A total of four vending sites then were randomly selected from each list.

This procedure additionally ensured that for each of the 30 most commonly available street foods, all four of the samples were collected from different vending sites.

During food sample collection, when it was not possible to find a food in the randomly selected location, the vending site was replaced by the geographically closest site that sold the required food, as identified during the data collection steps.

In sum, a total of 120 samples were collected, corresponding to four samples of each of the 30 foods identified. During data management, it was observed that two samples of the same food had been mistakenly collected

(industrial crackers – same brand and flavour). As such, the research team decided to exclude one of these samples for analysis purposes only. The results of the nutritional composition assessment are, therefore, presented for a total of 119 street food samples. The food samples collected corresponded to one unit or the usual portion sold. When foods were sold in small portions (e.g. small snacks, biscuits), the samples included the number of portions usually purchased and consumed. The 30 food samples are depicted in Annex 1.

Processing of food samples for analysis

Each individual sample was photographed and weighted in order to report on portion sizes. All samples, solid and semi-solid, were ground mechanically, homogenized and separated into four aliquots. The aliquots were stored in individually labelled rigid plastic containers with covers and inside closed plastic bags. After preparation, each container was stored in a freezer at-18 °C awaiting chemical analysis. Samples were defrosted and analysed immediately after homogenization. The chemical analysis comprised determination of the content of TFA, free sugars, sodium and potassium for each product. For TFA analysis, the fat fraction was extracted using organic solvents and a portion of 0.2 g of the extracted fat was converted to fatty acid methyl esters and separated by gas chromatography, as described in Gonçalves Albuquerque et al. *(31)*. For free sugars analysis, inversion of sugars in the filtrate was performed after dissolving the product and treating with Zinc Sulfate ($ZnSO_4$) and Sodium Hydroxide (NaOH) solutions. The final content of sugars was determined by iodometric titration. Sodium and potassium analyses were performed by an inductively coupled plasma optical emission spectrometer after acid digestion in a closed-vessel microwave system as described by Nascimento et al. *(32)*.

All samples were analysed in duplicate and the analytical results represent the mean of the two determinations, expressed in grams per 100 g of fresh food. These values were further computed into grams per serving, using the portion sizes collected.

Statistical analysis

The street food environment was characterized by descriptive statistics and spatial analysis. The locations of the vending sites were mapped and the characteristics of the sites and the foods they offered are presented as proportions.

The TFA, free sugars, sodium and potassium content of each food are presented as means and ranges per serving and as the mean proportion of the recommended intake of each nutrient, according to WHO guidelines *(9,13,16,33)*. Mean serving sizes, calculated as the mean of individual samples collected for each food, are also presented.

Results

Distribution of selected vending sites

The randomly selected street food vending sites were widely spread across the city of Tbilisi and followed a distribution pattern similar to the overall layout of all eligible vending sites.

Characteristics of vendors and vending sites

Some of the characteristics of street food vending sites and vendors in Tbilisi are presented in Table 3. The highest proportion of sites was in the Didube-Chughureti district (25.8%). All selected vending sites were stationary, kiosks (82.5%) being the most prevalent physical setups, followed by stands, stalls or booths (17.5%). Most vendors were women (85.0%) and employees of the business (80%).

Almost all vendors had access to clean water (96.7%) and most reported having access to a toilet while working (84.2%). When asked where they usually washed their hands during the day, 60.8% replied "private washing basin" and 37.5% "toilet". Three vendors reported that they had no place to wash their hands. All vendors reported having access to electricity.

All vendors reported that the vending site operated seven days a week throughout the year, regardless of the weather.

Table 3. Characteristics of street food vendors in Tbilisi, overall and by district

	All (*n* = 120)	District				
		Didube-Chughureti (*n* = 31)	*Gldani-Nadzaladevi* (*n* = 30)	*Isani-Samgori* (*n* = 28)	*Saburtalo* (*n* = 24)	*Vake* (*n* = 7)
Type of vendor (%)						
Stationary	100.0	100.0	100.0	100.0	100.0	100.0
Mobile	0.0	0.0	0.0	0.0	0.0	0.0
Physical setup (%)						
Kiosk	82.5	32.3	100.0	100.0	100.0	100.0
Stand, stall or booth	17.5	67.7	0.0	0.0	0.0	0.0
Sex (%)						
Women	85.0	90.3	80.0	82.1	87.5	85.7
Men	15.0	9.7	20.0	17.9	12.5	14.3
Owner (%)						
No	80.0	61.3	93.3	85.7	79.2	85.7
Yes	20.0	38.7	6.7	14.3	20.8	14.3

Characteristics of street food offered in Tbilisi

Foods were sold at 98.3% of vending sites (kiosks: 98.0%; stands, stalls or booths: 100.0%). The distribution of the different food categories in each district followed similar patterns. Among the sites selling food other than fruit, those selling only homemade foods were more prevalent (80.5%) than sites selling exclusively industrial foods (19.5%). The distribution of food types was also similar to the overall pattern across most districts, except in Gldani-Nadzaladevi, where the proportion of homemade and industrial foods was more equal (homemade:

57.1%; industrial: 42.9%). Fruit was unavailable in the street food vending sites that sold foods. Beverages were available at 78.3% of vending sites (kiosks: 81.8%; stands, stalls or booths: 61.9%) (Table 4).

Table 4. Street foods offered at all vending sites, by physical setup and district, in Tbilisi

	All (*n* = 120)	Physical setup		District				
		Kiosk (*n* = 99)	*Stand, stall, booth* (*n* = 21)	*Didube-Chughureti* (*n* = 31)	*Gldani-Nadzaladevi* (*n* = 30)	*Isani-Samgori* (*n* = 28)	*Saburtalo* (*n* = 24)	*Vake* (*n* = 7)
Foods (%)	98.3	98.0	100.0	100.0	93.3	100.0	100.0	100.0
Homemade	80.5	76.3	100.0	90.3	57.1	82.1	87.5	100.0
Industrial	19.5	23.7	0.0	9.7	42.9	17.9	12.5	0.0
Fruit (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beverages (%)	78.3	81.8	61.9	64.5	93.3	89.3	66.7	71.4

The most common homemade foods sold in the streets of Tbilisi were *lobiani* (78.9%), *khachapuri* (72.6%), hot dogs (35.8%) and pizza *(*34.7%). Table 5 lists the preparation, packaging and storage temperature of these foods. All foods were usually prepared on the same day they were sold (*lobiani* 97.2%; *khachapuri* 97.1%; hot dogs 94.1%; pizza 93.9%) or one day before (ranging from 2.8% for *lobiani* to 6.1% for pizza). The most common place of preparation was the vending site (ranging from 97.1% for hot dogs to 100.0% for *lobiani*, *khachapuri* and pizza) and all foods sold were manufactured largely by the employees directly (from 98.6% for *lobiani* to 100% for *khachapuri*, hot dog and pizza). At one of the vending sites selling *lobiani,* the food handler was the owner. Most foods were available unpackaged (ranging from 97.1% for hot dog *to* 100% *for lobiani*, *khachapuri* and pizza). Hot dog was manually packaged at one vending site. Generally, foods were stored at room temperature (80.3% of *lobiani*, 79.7% of *kchachapuri*, 85.3% of hot dogs and 78.8% of pizzas) or kept warm (ranging from 11.8% for hot dog to 21.2% for pizza). Hot dogs were available cold at one vending site.

Table 5. Characteristics of the four homemade foods most commonly offered at street food vending sites in Tbilisi

	Lobiani (*n* = 75)[a]		*Kchachapuri* (*n* = 69)		Hot dogs (*n* = 34)		Pizza (*n* = 33)	
Date of preparation, *n* (%)	n	%	n	%	n	%	n	%
Same day	69	97.2	67	97.1	32	94.1	31	93.9
1 day before	2	2.8	2	2.9	2	5.9	2	6.1
2 days before	0	0.0	0	0.0	0	0.0	0	0.0
> 2 days before	0	0.0	0	0.0	0	0.0	0	0.0
Place of preparation, *n* (%)								
At home	0	0.0	0	0.0	0	0.0	0	0.0
At the vending site	71	100.0	69	100.0	33	97.1	33	100.0
Both	0	0.0	0	0.0	0	0.0	0	0.0
Bought from another vendor	0	0.0	0	0.0	0	0.0	0	0.0
Restaurant or cafeteria	0	0.0	0	0.0	1	2.9	0	0.0
Bakery	0	0.0	0	0.0	0	0.0	0	0.0
Food handler (preparation), *n* (%)								
Employees	70	98.6	69	100.0	34	100.0	33	100.0
Owner	1	1.4	0	0.0	0	0.0	0	0.0
Relatives	0	0.0	0	0.0	0	0.0	0	0.0
Does not know	0	0.0	0	0.0	0	0.0	0	0.0

Table 5. Contd.

	Lobiani (*n* = 75)[a]		*Kchachapuri* (*n* = 69)		Hot dogs (*n* = 34)		Pizza (*n* = 33)	
Packaging, *n* (%)								
Industrially packaged	0	0.0	0	0.0	0	0.0	0	0.0
Manually packaged	0	0.0	0	0.0	1	2.9	0	0.0
No package	71	100.0	69	100.0	33	97.1	33	100.0
Storage temperature at time of selling, *n* (%)								
Cold-chain	0	0.0	0	0.0	1	2.9	0	0.0
Room temperature	57	80.3	55	79.7	29	85.3	26	78.8
Warm	14	19.7	14	20.3	4	11.8	7	21.2

[a] Data from four vending sites is missing due to misclassification during collection.

A wide variety of beverages was available at both kiosks and stands, stalls or booths in Tbilisi (Table 6). Most commonly sold were soft drinks (94.7%), water (89.4%) and energy drinks (64.9%). Overall, offerings were similar across all physical setups, except for fresh juice, alcoholic beverages, kefir and yoghurt which were only available at kiosks. Distribution of drink types by district was similar for the post part; however, some types of beverages were available at higher proportions in specific districts when compared with overall availability: this was the case for alcoholic beverages in the Gldani-Nadzaladevi district (25.0% vs. 13.8%), lemonade in the Isani-Samgori district (64.0% vs. 35.1%) and tea and fresh juice in the Saburtalo district (50.0% vs. 28.7% and 68.8% vs. 17.0%,, respectively) (Table 6).

Table 6. Beverages offered at street food vending sites in Tbilisi, by physical setup and district

Type of beverage (%)	All (*n* = 94)	Physical setup		District				
		Kiosk (*n* = 81)	Stand, stall, booth (*n* = 13)	*Didube-Chughureti* (*n* = 20)	*Gldani-Nadzaladevi* (*n* = 28)	*Isani-Samgori* (*n* = 25)	*Saburtalo* (*n* = 16)	*Vake* (*n* = 5)
Soft drinks	94.7	93.8	100.0	100.0	96.4	84.0	100.0	100.0
Water	89.4	88.9	92.3	95.0	85.7	84.0	93.8	100.0
Energy drinks	64.9	66.7	53.9	50.0	82.1	28.0	100.0	100.0
Juice	59.6	65.4	23.1	35.0	67.9	44.0	93.8	80.0
Coffee	41.5	42.0	38.5	40.0	46.4	24.0	50.0	80.0
Lemonade	35.1	39.5	7.7	5.0	35.7	64.0	31.3	20.0
Tea	28.7	29.6	23.1	25.0	7.1	28.0	50.0	100.0
Fresh juice	17.0	19.8	0.0	0.0	3.6	0.0	68.8	80.0
Alcoholic beverages	13.8	16.1	0.0	0.0	25.0	16.0	12.5	0.0
Milk	3.2	2.5	7.7	5.0	3.6	0.0	6.3	0.0
Fermented beverages	4.3	3.7	7.7	5.0	3.6	4.0	6.3	0.0
Kefir	2.1	2.5	0.0	0.0	3.6	0.0	6.3	0.0
Matsoni	3.2	2.5	7.7	5.0	0.0	4.0	6.3	0.0
Yoghurt	2.1	2.5	0.0	0.0	3.6	0.0	6.3	0.0

Nutritional composition of street foods

The nutritional composition of the 30 most commonly available street foods collected in Tbilisi is shown in Tables 7 and 8. The total energy, protein, carbohydrates, free sugars, total fat, TFA, sodium and potassium content varied considerably among the products analysed.

The mean protein content per serving was highest in homemade *shawarma* (mean: 90.8 g; range: 63.9–130.1 g), *megruli* (mean: 39.1 g; range: 30.1–54.0 g) and *guruli khachapuri* (mean: 38.7 g; range: 33.8–47.4 g). The mean protein content per serving was lowest in industrial loose cake (3.1 g), crackers (2.3 g) and chips (1.5 g) (Table 7).

The mean total carbohydrate content per serving was highest in homemade *lavashi* bread (mean: 130.8 g; range: 119.3–143.6 g), *shawarma* (mean: 129.3 g; range: 114.2–147.1 g) and traditional *lobiani* (mean: 123.6 g; range: 121.1–126.4 g). The mean total carbohydrate content per serving was lowest in industrial salty sticks (24.9 g), crackers (16.2 g) and chips (14.5 g). The mean free sugars content per serving was highest in industrial chocolate (mean: 40.1 g; range: 30.3 g–46.3 g), homemade cream cake (mean: 31.0 g; range: 24.2 g–39.0 g) and homemade loose cake (mean: 30.8; range: 22.5–40.1 g), corresponding to an average of 80.1% (range: 60.7–92.7%), 62.0% (range: 48.5–78.0%) and 61.6% (range: 45.1–80.2%) of the recommended maximum daily free sugars intake *(16)*, respectively. The mean free sugar content per serving was lowest in industrial salted sunflower seeds (1.9 g), salty sticks (1.5 g) and chips (0.6 g), corresponding to an average of 3.9%, 3.0% and 1.1% of the maximum daily recommendation *(16)* (10% of total energy intake), respectively (Table 7).

The mean total fat content per serving was highest in homemade *shawarma* (mean: 45.3; range: 28.9–69.6), layered *khachapuri* (mean: 45.0 g; range: 32.5–56.5 g) and *chebureki* (mean: 37.6 g; range: 19.9–55.0 g). The mean total fat content per serving was lowest in industrial salty sticks (2.7 g), tea biscuits (1.7 g) and homemade *lavashi* bread (1.3 g). The mean TFA content per serving was highest in homemade *khachapuri*: khachapuri *megruli* (mean: 0.99 g; range: 0.20 g–1.79 g), *imeruli* (mean: 0.69 g; range: 0.41 g–0.94 g) and *guruli* (mean: 0.66; range: 0.34–1.07g), corresponding to averages of 44.6% (range: 8.9–76.7%), 30.8% (range: 18.7–42.3%) and 29.6% (range: 15.3–48.1%) of the recommended maximum daily TFA intake *(9)*, respectively.

The mean TFA content per serving was lowest in industrial salty sticks (0.02 g), tea biscuits (0.01 g) and *lavashi* bread (0.00 g), corresponding to an average of 0.8%, 0.7% and 0.0% of the maximum daily recommendations *(9)*, respectively (Table 7). The mean TFA content per serving was highest in homemade *khachapuri*, respectively khachapuri *megruli* (mean: 0.33 g; range: 0.06 –0.65 g), *imeruli* (mean: 0.69 g; range: 0.41 g–0.94 g) and *guruli* (mean: 0.66; range: 0.34-1.07g), exceeding the WHO recommendation for maximum TFA content of 2 g per 100 g of total fat in foods *(10)*. Homemade *megruli khachapuri* (134.9%), *imeruli khachapuri* (121.9%) and homemade pizza (112.0%) presented the highest values (Table 9).

Concerning the energy value of collected street foods, the mean content per serving was highest in homemade *shawarma* (mean: 1288.0 kcal; range 1017.6–1499.4 kcal), *megruli* (mean: 885.9 kcal; range: 793.5–1046.0 kcal) and *guruli* khachapuri (mean: 847.6 kcal; range: 772.8–1023.3 kcal). The mean energy content per serving was lowest in industrial salty sticks (138.2 kcal), chips (136.1 kcal) and crackers (Table 7).

The highest mean sodium content per serving was found in homemade *shawarma* (mean: 2098 mg; range: 1109–3278 mg), *khachapuri megruli* (mean: 1182 mg; range: 521–2038 mg) and *khachapuri guruli* (mean: 1048 mg; range: 565–1351 mg), corresponding to an average of 104.9% (range: 55.5–163.9%), 59.1% (range: 26.0–101.9%) and 52.4% (range: 28.2–67.5%) of the recommended maximum daily intake *(33)*, respectively. Industrial chocolate (68 mg), crackers (66 mg) and wafers (65 mg) had the lowest mean sodium content per serving, corresponding to an average of 3.4%, 3.3% and 3.3% of the maximum daily recommendation *(33)*, respectively (Table 9).

The highest mean potassium content per serving was found in homemade *shawarma* (mean: 992 mg; range: 486–1657 mg), ham (mean: 479 mg; range: 140–1273 mg), traditional *lobiani (*mean: 477 mg; range: 211–649 mg) and *imeruli khachapuri* (mean: 357 mg; range: 135–510 mg), corresponding to an average of 28.3% (range: 13.8–47.2%), 13.7% (range: 4.0–36.3%), 13.6% (range: 6.0–18.5%) and 10.2% (range: 3.9–14.5%) of the recommended minimum daily intake *(13)*, respectively. Industrial cookies (32 mg), salty sticks (31 mg) and crackers (13 mg) had the lowest mean potassium content per serving, corresponding to an average of 0.9%, 0.9% and 0.4% of the minimum daily recommendation *(13)*, respectively (Table 9).

Table 7. Nutritional composition per serving of the street food samples collected in Tbilisi (energy and macronutrients)

		Mean serving size (min–max)	Protein	Carbohydrates			Fat				Total energy
				Total	Free sugars		Total	TFA			
			Mean (min–max) (g/serving)	Mean carbohydrates (min–max) (g/serving)	Mean sugar (min–max) (g/serving)	% of recom. (< 10% TEV)	Mean total fat (min–max) (g/serving)	Mean (min–max) (g/serving)	%max. recom. TFA (< 1% TEV)	% max. recom. (2 g TFA/ 100 g fat)	Mean (min–max) (kcal/serving)
Industrial food											
Chips	4	25 (25–25)	1.5 (1.4–1.7)	14.5 (13.9–14.9)	0.6 (0.3–0.9)	1.1	8.0 (7.6–8.8)	0.04 (0.02–0.05)	1.8	24.7	136.1 (133.5–140.0)
Chocolate	4	83 (77–86)	5.7 (4.8–7.7)	57.7 (51.2–66.1)	40.1 (30.3–46.3)	80.1	16.4 (11.6–20.2)	0.16 (0.07–0.24)	7.0	47.5	401.5 (373.0–437.3)
Cookies	4	47 (33–55)	3.3 (2.5–4.2)	31.7 (21.1–37.1)	12.1 (9.1–18.9)	24.2	6.8 (3.8–8.7)	0.05 (0.01–0.07)	2.2	35.8	200.5 (168.9–236.1)
Crackers	3	25 (25–25)	2.3 (2.2–2.5)	16.2 (14.1–18.2)	2.3 (1.8–2.6)	4.6	4.8 (2.7–7.0)	0.03 (0.02–0.05)	1.4	31.5	117.6 (107.2–128.3)
Croutons	4	70 (63–78)	7.9 (7.0–9.3)	53.5 (47.7–59.0)	3.8 (3.0–4.7)	7.6	5.5 (3.6–7.1)	0.04 (0.01–0.08)	1.7	34.3	295.1 (258.0–336.9)
Loose cake	4	55 (55–55)	3.1 (2.7–3.7)	31.3 (26.7–34.9)	17.0 (13.8–19.4)	33.9	10.9 (6.8–15.2)	0.07 (0.04–0.11)	3.3	34.0	235.7 (211.4–255.2)
Salty sticks	4	33 (33–33)	3.5 (3.2–3.8)	24.9 (24.2–25.6)	1.5 (1.0–2.4)	3.0	2.7 (1.7–4.7)	0.02 (0.01–0.03)	0.8	34.7	138.2 (131.8–151.3)
Sunflower seeds (salted)	4	80 (80–80)	13.6 (11.0–15.1)	39.3 (32.5–46.2)	1.9 (1.7–2.2)	3.9	23.4 (19.2–29.8)	0.07 (0.03–0.10)	3.0	14.1	422.3 (401.6–457.6)
Tea biscuits	4	55 (55–55)	6.2 (5.6–6.7)	43.9 (42.8–44.9)	7.7 (4.7–9.6)	15.4	1.7 (1.0–2.5)	0.01 (0.00–0.02)	0.7	43.3	215.3 (208.2–222.7)
Wafers	4	80 (80–80)	4.6 (3.5–5.8)	48.1 (46.7–50.3)	24.3 (21.7–28.4)	48.6	25.8 (22.1–28.7)	0.15 (0.06–0.23)	6.7	28.9	442.6 (422.1–458.9)
Homemade food											
Baklava	4	137 (76–238)	10. (5.6–19.3)	70.1 (42.5–107.3)	29.1 (19.5–42.5)	58.2	23.0 (14.7–34.9)	0.12 (0.07–0.24)	5.4	26.0	527.5 (379.7–820.6)
Bread *(lavashi)*	4	250 (250–250)	23.7 (22.1–26.5)	130.8 (119.3–143.6)	5.3 (3.5–7.5)	10.5	1.3 (0.8–2.5)	0.00 (0.00–0.00)	0.0	0.0	629.5 (588.5–677.8)
Bun	4	132 (98–168)	8.9 (6.5–11.2)	78.7 (45.1–108.2)	28.0 (16.8–48.6)	56.0	8.5 (4.5–15.3)	0.05 (0.27–0.08)	2.1	27.4	427.3 (343.8–544.2)
Chebureki	4	287 (272–312)	25.3 (21.5–29.9)	96.5 (74.4–109.7)	4.5 (3.0–7.2)	9.0	37.6 (19.9–55.0)	0.48 (0.15–0.75)	21.6	63.7	825.7 (687.4–1013.8)
Cream cake	4	166 (95–218)	8.0 (4.6–10.4)	80.6 (48.7–98.1)	31.0 (24.2–39.0)	62.0	26.5 (6.2–47.5)	0.30 (0.06–0.58)	13.3	55.8	593.4 (268.8–862.0)
Hamburger	4	259 (176–405)	28.8 (18.9–37.9)	85.2 (52.0–136.2)	5.0 (3.0–6.5)	10.1	15.3 (10.8–23.1)	0.12 (0.07–0.20)	5.2	37.8	593.4 (409.1–904.4)
Hotdog	4	153 (118–194)	15.3 (9.9–20.5)	52.1 (35.1–67.9)	5.6 (0.9–11.0)	11.1	16.8 (13.4–20.2)	0.16 (0.09–0.22)	7.2	47.3	421.1 (345.5–511.4)
Khachapuri (Guruli)	4	335 (300–380)	38.7 (33.8–47.4)	104.7 (93.1–123.6)	8.5 (7.6–10.0)	16.9	30.5 (17.4–44.5)	0.66 (0.34–1.07)	29.6	107.9	847.6 (772.8–1023.3)
Khachapuri (Imeruli)	4	291 (230–352)	31.1 (20.4–46.0)	112.9 (85.6–130.4)	7.8 (3.9–10.4)	15.5	28.1 (24.6–33.4)	0.69 (0.41–0.94)	30.8	121.9	829.0 (645.6–1006.3)
Khachapuri (layered)	4	219 (183–243)	21.8 (14.8–27.8)	77.3 (68.8–91.4)	4.5 (4.0–4.9)	9.1	45.0 (32.5–56.5)	0.51 (0.29–0.78)	23.1	57.1	801.8 (649.9–955.4)
Khachapuri (Megruli)	4	319 (263–395)	39.1 (30.1–54.0)	99.8 (74.5–125.7)	9.6 (7.1–13.9)	19.2	36.7 (23.5–46.0)	0.99 (0.20–1.79)	44.6	134.9	885.9 (793.5–1046.0)
Kubdari	4	319 (274–353)	36.6 (32.3–42.2)	99.5 (83.0–117.1)	5.3 (0.0–9.2)	10.7	18.7 (10.8–33.7)	0.14 (0.07–0.21)	6.3	37.3	713.1 (620.4–769.1)
Lobiani (ham)	4	248 (168–323)	19.7 (12.4–27.0)	83.8 (56.8–111.7)	4.4 (3.4–5.5)	8.8	33.9 (26.6–42.4)	0.25 (0.18–0.31)	11.1	36.3	719.2 (552.6–851.7)
Lobiani (traditional)	4	302 (288–325)	24.1 (22.3–26.0)	123.6 (121.1–126.4)	7.6 (5.0–8.9)	15.1	18.8 (4.4–30.2)	0.09 (0.03–0.17)	3.9	23.3	760.3 (628.4–873.9)
Loose cake/ muffin	4	114 (87–141)	6.7 (4.0–9.0)	63.0 (44.9–80.9)	30.8 (22.5–40.1)	61.6	17.7 (10.3–28.7)	0.22 (0.14–0.32)	9.7	61.1	437.7 (308.2–502.9)
Pizza	4	197 (149–250)	18.2 (13.8–29.6)	62.3 (45.5–80.0)	5.8 (4.5–7.2)	11.6	20.0 (9.8–30.0)	0.45 (0.25–0.62)	20.2	112.0	501.8 (398.2–708.0)
Savoury pie (meat)	4	211 (143–267)	21.4 (16.9–30.4)	65.1 (40.1–81.4)	2.8 (0.0–4.3)	5.7	27.9 (11.0–42.2)	0.34 (0.11–0.86)	15.3	61.0	597.2 (489.8–826.9)
Savoury pie (potato)	4	175 (157–199)	8.8 (7.7–11.3)	55.9 (37.6–73.0)	3.2 (1.7–5.3)	6.5	21.7 (9.7–44.7)	0.12 (0.06–0.27)	5.5	28.2	453.6 (369.4–586.2)
Shawarma	4	569 (480–700)	90.8 (63.9–130.1)	129.3 (114.2–147.1)	21.3 (9.9–45.5)	42.6	45.3 (28.9–69.6)	0.46 (0.28–0.67)	20.7	50.7	1288.0 (1017.6–1499.4)
Sweet puff pastry	4	90 (27–139)	6.2 (2.0–10.1)	59.2 (16.5–94.5)	21.6 (4.6–33.7)	43.2	9.9 (5.8–17.7)	0.11 (0.02–0.27)	5.0	56.2	350.6 (129.2–513.0)

Percentages of WHO recommended levels were computed for an average adult with a daily intake of 2000 kcal.
WHO recommendations: TFA: < 1% total energy value/day *(9)*; ≤ 2 g TFA/100 g total fat *(10)*; free sugars < 10% total energy value/day *(16)*.

Table 8. Nutritional composition of street food samples collected in Tbilisi (fatty acid profile)

		Fatty acid profile								
		Mean serving size (min–max) (g/serving)	Mean SFA (min–max) (g/serving)	Mean MUFA (min–max) (g/serving)	Mean PUFA (min–max) (g/serving)	Mean n–6 (min–max) (g/serving)	Mean n–3 (min–max) (g/serving)	Mean TFA (min–max) (g/serving)	Mean TFA (min–max) (g/100 g)	% TFA maximum recommendation (<2g/100g fat)
Industrial food										
Chips	4	25 (25–25)	1.7 (0.6–4.0)	4.6 (2.6–6.0)	1.7 (0.9–3.9)	1.6 (0.8–3.9)	0.1 (0.0–0.1)	0.04 (0.02–0.05)	0.16 (0.07–0.22)	24.7 (11.6–33.7)
Chocolate	4	83 (77–86)	10.8 (7.0–14.9)	4.5 (0.7–6.9)	1.0 (0.7–1.6)	0.9 (0.6–1.5)	0.1 (0.0–0.1)	0.16 (0.07–0.24)	0.19 (0.08–0.28)	47.5 (41.3–150.1)
Cookies	4	47 (33–55)	3.6 (2.0–4.7)	2.4 (1.4–3.3)	0.8 (0.5–1.1)	0.8 (0.5–1.1)	0.0 (0.0–0.0)	0.05 (0.01–0.07)	0.11 (0.03–0.21)	35.8 (9.0–43.7)
Crackers	3	25 (25–25)	1.7 (0.9–2.2)	1.8 (0.9–2.4)	1.4 (0.6–2.5)	1.3 (0.6–2.5)	0.0 (0.0–0.0)	0.03 (0.02–0.05)	0.12 (0.08–0.20)	31.5 (12.0–31.5)
Croutons	4	70 (63–78)	0.7 (0.6–0.8)	3.1 (1.1–4.3)	1.7 (0.7–2.1)	1.5 (0.7–1.9)	0.2 (0.0–0.3)	0.04 (0.01–0.08)	0.50 (0.01–0.10)	34.3 (3.4–50.5)
Loose cake	4	55 (55–55)	3.7 (1.6–6.9)	3.8 (2.0–6.3)	3.4 (1.9–6.3)	3.3 (1.8–6.3)	0.0 (0.0–0.1)	0.07 (0.04–0.11)	0.13 (0.08–0.19)	34.0 (26.4–66.6)
Salty sticks	4	33 (33–33)	1.3 (0.7–2.2)	1.0 (0.6–1.7)	0.4 (0.3–0.7)	0.4 (0.3–0.7)	0.0 (0.0–0.0)	0.02 (0.01–0.03)	0.06 (0.02–0.08)	34.7 (5.0–16.1)
Sunflower seeds (salted)	4	80 (80–80)	2.9 (2.5–3.7)	8.9 (4.5–12.3)	11.6 (9.8–13.7)	11.5 (9.6–13.6)	0.1 (0.0–0.1)	0.07 (0.03–0.10)	0.08 (0.03–0.12)	14.1 (17.4–61.9)
Tea biscuits	4	55 (55–55)	0.6 (0.2–1.1)	0.5 (0.3–0.7)	0.5 (0.2–0.8)	0.5 (0.2–0.8)	0.0 (0.0–0.0)	0.01 (0.00–0.02)	0.03 (0.01–0.04)	43.3 (3.0–14.1)
Wafers	4	80 (80–80)	9.9 (2.9–14.6)	9.5 (7.7–11.1)	6.2 (2.0–13.1)	6.1 (1.9–13.1)	0.1 (0.0–0.2)	0.15 (0.06–0.23)	0.19 (0.07–0.29)	28.9 (35.5–142.5)
Homemade food										
Baklava	4	137 (76–238)	8.8 (4.2–16.2)	8.4 (5.5–13.9)	5.7 (2.4–8.3)	5.0 (2.1–6.8)	0.6 (0.1–1.6)	0.12 (0.07–0.24)	0.08 (0.07–0.10)	26.0 (44.6–152.6)
Bread *(lavashi)*	4	250 (250–250)	0.3 (0.2–0.6)	0.2 (0.1–0.4)	0.7 (0.4–1.5)	0.7 (0.4–1.4)	0.0 (0.0–0.1)	0.00 (0.00–0.00)	0.00 (0.00–0.00)	0.0 (0.0–0.0)
Bun	4	132 (98–168)	1.5 (0.5–2.4)	2.7 (1.5–5.0)	4.3 (1.8–8.3)	4.3 (1.8–8.3)	0.0 (0.0–0.1)	0.05 (0.27–0.08)	0.04 (0.02–0.05)	27.4 (170.6–47.7)
Chebureki	4	287 (272–312)	17.0 (8.9–24.6)	15.5 (8.4–23.0)	4.7 (1.7–7.6)	4.5 (1.6–7.5)	0.1 (0.1–0.2)	0.48 (0.15–0.75)	0.16 (0.05–0.24)	63.7 (92.5–469.8)
Cream cake	4	166 (95–218)	12.5 (2.6–22.5)	9.5 (1.9–17.5)	4.2 (1.7–7.0)	4.1 (1.7–6.9)	0.0 (0.0–0.1)	0.30 (0.06–0.58)	0.16 (0.06–0.26)	55.8 (35.1–359.8)
Hamburger	4	259 (176–405)	2.8 (2.0–3.9)	4.6 (3.3–5.8)	7.7 (5.3–13.2)	7.7 (5.2–13.2)	0.1 (0.0–0.1)	0.12 (0.07–0.20)	0.04 (0.03–0.06)	37.8 (43.4–125.1)
Hotdog	4	153 (118–194)	5.3 (4.7–6.8)	6.2 (4.8–7.0)	5.2 (2.4–8.2)	5.1 (2.2–7.9)	0.1 (0.1–0.2)	0.16 (0.09–0.22)	0.10 (0.07–0.12)	47.3 (56.0–136.5)
Khachapuri (guruli)	4	335 (300–380)	11.3 (5.0–17.3)	11.0 (6.7–15.6)	7.5 (4.0–10.5)	7.3 (3.7–10.2)	0.2 (0.1–0.3)	0.66 (0.34–1.07)	0.20 (0.10–0.28)	107.9 (211.5–667.3)
Khachapuri (imeruli)	4	291 (230–352)	9.4 (8.3–9.9)	9.9 (8.7–11.7)	8.1 (5.9–11.1)	7.9 (5.8–10.9)	0.1 (0.1–0.2)	0.69 (0.41–0.94)	0.25 (0.12–0.38)	121.9 (258.8–586.0)
Khachapuri (layered)	4	219 (183–243)	22.2 (15.4–27.3)	14.4 (10.7–19.3)	7.9 (6.1–9.4)	7.8 (6.0–9.2)	0.1 (0.1–0.2)	0.51 (0.29–0.78)	0.23 (0.14–0.33)	57.1 (184.1–485.3)
Khachapuri (megruli)	4	319 (263–395)	14.4 (8.1–21.5)	12.8 (8.4–15.8)	8.5 (6.8–11.1)	8.3 (6.7–10.9)	0.2 (0.1–0.3)	0.99 (0.20–1.79)	0.33 (0.06–0.65)	134.9 (123.7–1119.6)
Kubdari	4	319 (274–353)	4.0 (1.6–7.3)	7.0 (4.0–12.5)	7.6 (5.0–13.7)	7.5 (5.0–13.3)	0.1 (0.0–0.2)	0.14 (0.07–0.21)	0.04 (0.02–0.08)	37.3 (40.9–130.3)
Lobiani (ham)	4	248 (168–323)	12.8 (9.3–16.0)	10.3 (8.2–11.4)	10.6 (7.6–14.7)	10.4 (7.4–14.5)	0.2 (0.2–0.2)	0.25 (0.18–0.31)	0.10 (0.07–0.15)	36.3 (110.2–194.3)
Lobiani (traditional)	4	302 (288–325)	4.6 (0.7–7.9)	6.7 (1.6–10.9)	7.5 (2.1–12.1)	7.3 (2.0–11.9)	0.1 (0.0–0.2)	0.09 (0.03–0.17)	0.03 (0.01–0.06)	23.3 (16.6–104.6)
Loose cake/ muffin	4	114 (87–141)	4.8 (1.3–11.5)	6.0 (3.0–9.7)	6.6 (4.4–9.1)	6.5 (4.2–8.8)	0.1 (0.0–0.3)	0.22 (0.14–0.32)	0.21 (0.11–0.36)	61.1 (89.1–197.2)
Pizza	4	197 (149–250)	8.1 (3.5–14.6)	6.4 (3.4–9.7)	5.0 (2.6–6.4)	4.9 (2.4–6.3)	0.1 (0.1–0.2)	0.45 (0.25–0.62)	0.23 (0.13–0.35)	112.0 (157.6–387.1)
Savoury pie (meat)	4	211 (143–267)	8.7 (3.1–16.7)	10.6 (4.7–15.3)	8.2 (3.1–15.3)	8.1 (2.9–15.1)	0.2 (0.0–0.2)	0.34 (0.11–0.86)	0.15 (0.05–0.32)	61.0 (66.1–536.1)
Savoury pie (potato)	4	175 (157–199)	8.1 (1.2–17.8)	8.1 (3.3–18.1)	5.3 (0.0–8.5)	5.3 (3.0–8.5)	0.0 (0.0–0.1)	0.12 (0.06–0.27)	0.07 (0.04–0.14)	28.2 (39.2–168.2)
Shawarma	4	569 (480–700)	9.6 (4.2–16.2)	15.4 (8.4–24.9)	19.8 (13.6–28.0)	19.6 (13.4–27.7)	0.2 (0.1–0.4)	0.46 (0.28–0.67)	0.08 (0.05–0.14)	50.7 (174.5–416.9)
Sweet puff pastry	4	90 (27–139)	4.3 (0.7–8.4)	3.3 (1.4–5.9)	2.2 (0.8–3.7)	2.2 (0.8–3.7)	0.0 (0.0–0.1)	0.11 (0.02–0.27)	0.11 (0.06–0.21)	56.2 (14.6–167.7)

Note: MUFA: monounsaturated fatty acids; n–3: omega 3; n–6: omega 6; PUFA: polyunsaturated fatty acids; SFA: saturated fatty acids; TEV: Total Energy Value.
WHO recommendation: TFA: ≤ 2 g/100 g total fat *(10)*.

Table 9. Nutritional composition per serving of the street food samples collected in Tbilisi (micronutrients).

		Mean serving size (min–max) (g/serving)	Sodium		Potassium	
			Mean Na (min–max) (mg/serving)	% of recom. (2000 mg)	Mean K (min–max) (mg/serving)	% of recom. (3510 mg)
Industrial food						
Chips	4	25 (25–25)	102 (47–141)	5.1	137 (52–211)	3.9
Chocolate	4	83 (77–86)	68 (51–105)	3.4	140 (52–254)	4.0
Cookies	4	47 (33–55)	98 (75–120)	4.9	32 (26–40)	0.9
Crackers	3	25 (25–25)	66 (43–104)	3.3	13 (8–24)	0.4
Croutons	4	70 (63–78)	221 (30–298)	11.1	208 (40–370)	5.9
Loose cake	4	55 (55–55)	89 (37–131)	4.4	47 (31–66)	1.3
Salty sticks	4	33 (33–33)	128 (37–219)	6.4	31 (9–51)	0.9
Sunflower seeds (salted)	4	80 (80–80)	590 (94–924)	29.5	294 (184–400)	8.4
Tea biscuits	4	55 (55–55)	93 (54–148)	4.7	53 (41–66)	1.5
Wafers	4	80 (80–80)	65 (37–98)	3.3	40 (24–49)	1.1
Homemade food						
Baklava	4	137 (76–238)	118 (32–160)	5.9	98 (32–163)	2.8
Bread *(lavashi)*	4	250 (250–250)	778 (140–1233)	38.9	188 (66–297)	5.3
Bun	4	132 (98–168)	93 (19–127)	4.6	70 (40–117)	2.0
Chebureki	4	287 (272–312)	631 (510–748)	31.5	188 (164–221)	5.3
Cream cake	4	166 (95–218)	119 (24–208)	5.9	74 (29–112)	2.1
Hamburger	4	259 (176–405)	592 (216–892)	29.6	245 (120–385)	7.0
Hotdog	4	153 (118–194)	334 (233–501)	16.7	113 (56–152)	3.2
Khachapuri (Guruli)	4	335 (300–380)	1048 (565–1351)	52.4	245 (101–410)	7.0
Khachapuri (Imeruli)	4	291 (230–352)	685 (322–1125)	34.2	357 (135–510)	10.2
Khachapuri (layered)	4	219 (183–243)	550 (66–845)	27.5	140 (80–208)	4.0
Khachapuri (Megruli)	4	319 (263–395)	1182 (521–2038)	59.1	258 (167–394)	7.3
Kubdari	4	319 (274–353)	631 (130–1079)	31.6	211 (82–329)	6.0
Lobiani (ham)	4	248 (168–323)	428 (247–723)	21.4	161 (0–308)	4.6
Lobiani (traditional)	4	302 (288–325)	603 (182–814)	30.1	477 (211–649)	13.6
Loose cake/ muffin	4	114 (87–141)	89 (32–212)	4.5	46 (12–105)	1.3
Pizza	4	197 (149–250)	922 (591–1315)	46.1	204 (81–283)	5.8
Savoury pie (meat)	4	211 (143–267)	453 (326–566)	22.7	168 (74–263)	4.8
Savoury pie (potato)	4	175 (157–199)	463 (298–588)	23.1	199 (148–245)	5.7
Shawarma	4	569 (480–700)	2098 (1109–3278)	104.9	992 (486–1657)	28.3
Sweet puff pastry	4	90 (27–139)	91 (9–172)	4.5	62 (14–126)	1.8

Percentages of WHO recommended levels were computed for an average adult with an intake of 2000 kcal.
WHO recommendations: sodium: < 2000 mg/day *(33)*; potassium: ≥ 3510 mg/day *(13)*.

Concluding remarks and recommended actions

The study reported here was conducted with standardized methods, to provide an overview of the street food context in Tbilisi. The street food offered is widely available across this eastern European city. Of the 120 eligible vendors interviewed, all worked in stationary vending sites and most were women and employees. Basic sanitary conditions were accessible for most vendors.

Foods were sold at 98.3% of the randomly selected street food vending sites and beverages at 73.8%. Among the sites selling foods, none sold fruit. Nevertheless, it is important to acknowledge that the availability of fruit may be underrepresented, given that sites selling exclusively unprepared fresh fruit were not included in the sample of eligible vending sites. In addition, it was observed that the overall potassium content of the street foods analysed in Georgia was low. Some homemade traditional foods containing vegetables and/or potatoes as ingredients, such as *shawarma*, *lobiani* and *khachapuri* had the highest contents of these nutrients per serving, which still represented only 10.2–28.3% of the recommended daily minimum potassium intake. Overall it is clear that one goal should be to increase the availability of nutritionally dense foods rich in fibre and sources of potassium, such as fruit and vegetables, for the urban population of Tbilisi, which accordingly must be pursued in street food vending sites.

Many different types of beverages were available in the Tbilisi street food environment. Soft drinks, water, energy drinks and juice were available at over half of all vending sites selling beverages, while coffee, tea and fermented beverages were available in lower proportions. Despite their high availability, these beverages were not selected for chemical analysis because their nutritional composition is known a priori. In fact, these findings provide some concern, given that soft drinks are acknowledged as a principal source of added sugar in the diet *(17)*. Moreover, concerning the nutritional composition of the most common street foods, the highest levels of free sugars per serving were found in industrial chocolate and homemade bakery products (cream cake, loose cake, *baklava* and bun), which are also acknowledged as principal sources of sugar. In all these foods, the mean free sugar content per serving corresponded to over 50% of the daily recommendation for an average adult consuming 2000 kcal according to WHO *(16)*. The high content of free sugars in many of the identified street foods may contribute to a high sugar and energy intake and weight gain, ultimately leading to the development of overweight, obesity or other NCDs such as diabetes *(17)*.

Although homemade foods were much more widely available in Tbilisi than industrial options, it is interesting to note the coexistence of traditional savoury and sweet pastries, bread and bakery products with more westernized fast foods such as pizza, hamburgers and hot dogs. Although these options are homemade, they may reflect the globalization of eating habits and it is accepted that they will include industrial ingredients, which is aligned with the nutrition transition observable in the WHO European Region *(7)*.

The highest amount of TFAs per serving was found mainly among homemade traditional savoury pastries, such as *khachapuri* and *chebureki* and in a homemade sandwich, *shawarma*. Among these foods, the mean TFA content varied between approximately 20–45% of the recommended maximum daily amount, reaching 76.7% in one of the samples of *megruli khachapuri*.

Homemade sandwiches and savoury snacks such as *shawarma*, *lobiani* and *khachapuri* had the highest contents of sodium per serving. For some types of *khachapuri* (*guruli* and *megruli*), an average portion surpassed half the recommended maximum daily intake of 2000 mg and an average shawarma portion surpassed this maximum limit *(33)*. Notably, some of the street food samples collected presented even higher sodium content, reaching, for example, 101.9% (*megruli khachapuri*) and 163.9% (*shawarma*) of the maximum daily recommendation. The high TFA and sodium levels in many traditional homemade foods indicate that there is room for improvement in culinary practices. The considerable variation in the nutritional composition observed for food samples collected from different vending sites suggests that this could be improved without affecting traditional gastronomy. Awareness should be raised among food vendors and consumers, for example, that adding less sugar and salt and using healthier fats and other ingredients would contribute to improving health at the national level.

The results of this report show that the promotion of healthy diets should be at the centre of national health priorities. Practical strategies to make the street food environment healthier should be incorporated into existing policies. For example, WHO has prepared guidance for the elimination of industrially produced TFA from the global food supply at the national level, the REPLACE trans-fat free by 2023 action package *(10)*. Georgia has shown commitment to the reduction/elimination of industrially produced TFAs. A study conducted in 2015–2016 in the country reported a slight reduction in industrial TFAs in biscuits, cakes and wafers sold in supermarkets, although being far from the recommendations *(34)*. Following this, in 2016 Georgia adopted a technical regulation that prohibited TFA content of over 2 g/100 g in vegetable oils, but soon after its adoption in 2017 this was changed to only apply to ready-to-eat food *(35)*. There is no information about the monitoring of execution of this regulation. Acting legal measures are less restrictive than the WHO recommended approach (applied to TFA content in all fats and covering all food products) and the findings of this study reinforce that committing to stronger regulatory measures could enable larger TFA reductions. By using as reference the recommendation of a maximum of 2 g of TFA per 100 g, four homemade street foods would surpass it (*guruli khachapuri* at 108%; pizza at 112%; *imeruli khachapuri* at 122% and *megruli khachapuri* at 135%) and seven (chebureki, cream cake, layered *khachapuri*, loose cake, meat savoury pie, shawarma and sweet puff pastry) would reach at least half this daily recommended limit. Among industrial foods, the higher proportion of the recommended limit would apply to chocolate at 48%. As such, the Government could adopt a target to limit the TFA content to < 2 g/100 g of fat in all foods. This limit should cover all food products in the food environment to ensure equity. This measure would be aligned with and supported by complementary measures of food security and nutrition.

Lowering the amount of free sugars, salt and TFA in ready-to-eat foods sold by street vendors may need a multifaceted approach. Defining strict labelling guidance for industrial products, namely ensuring the presentation of a nutrient declaration and an ingredient list might lead to food reformulation. As previously mentioned, such a multifaceted approach could involve additional education of street food vendors on limiting the use of sugar and salt and the use of healthier fats, as well as raising consumer awareness about the harmful effects of the excessive intake of these non-essential nutrients. The Government might consider additional measures to encourage the food industry, manufacturers and vendors to change to healthier ingredients. As street vendors and small-scale manufacturers are extremely price conscious due to the small profits they make their choice of ingredients, especially cooking fats, is likely to be strongly influenced by price. Increased availability and affordability of healthier oils for use by street vendors and manufacturers could result in significant changes in dietary intake, as has been observed in other contexts *(37)*. Dialogue with fats and oils producers could ensure compliance with legislation.

Such strategies will also require regular monitoring. As advocated by key global publications on food systems and food environments transformations *(37–41)*, the engagement of local and international food suppliers (e.g. the manufacturers of oils and fats used in freshly prepared products, wholesale producers, manufacturers of bread, pastries and confectionary, savoury snacks, drinks and processed meats) is a vital approach to monitor their compliance with regulations and guidance, while strengthening partnerships between stakeholders across the food system. Together, these activities would contribute significantly to the promotion of healthy diets and NCDs prevention in Georgia. The national NCD strategy may serve as an excellent starting point for implementing policies that engage all actors, including agencies that have the ultimate goal of improving the Georgian population's health status.

The findings of this study highlight the considerable potential for enhancing the nutritional value of street foods sold in Georgia. It underscores the importance of implementing health policies to curb the rise of diet-related NCDs while preserving the cultural significance of street food. Ensuring that food production is regulated and the population has access to safe, affordable and nutritious street food options is crucial in addressing NCDs and associated health inequities in urban areas.

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Annex 1. Selected food products analysed

Examples of homemade street foods collected in Tbilisi, Georgia

Baklava

Sweet pastry dessert made from puff pastry, chopped nuts, raisins and *merenga* (whipped and baked egg white). There are also versions of baklava made of filo layers, chopped nuts and syrup or honey.

Bread *(lavashi)*

Flatbread made with flour, water, yeast, sugar and salt.

Bun

Chebureki

Traditional fried savoury pastry generally filled with ground or minced meat, onions and other vegetables.

Cream cake

Hamburger

Hotdog

Khachapuri (guruli)

Traditional cheese-filled bread. The bread is leavened and allowed to rise, moulded into various shapes and then filled in the centre with cheese and chopped boiled egg.

Guruli khachapuri is filled with *imeruli* cheese and looks like a crescent-shaped calzone.

Khachapuri (imeruli)

Traditional Imeruli khachapuri. This type of khachapuri is filled with imeruli – a freshly made, less salty and crunchy cheese.

***Khachapuri* (layered)**

This type of khachapuri is made of puff pastry dough and filled with cheese.

Khachapuri (megruli)

This type of khachapuri is similar to *imeruli khachapuri* but contains a higher amount of cheese (in the filling and on top) and is coated with an egg glaze.

Kubdari

Traditional filled bread dish. The bread is leavened and allowed to rise. The filling contains pieces of meat (such as pork or beef), Georgian spices and onions.

***Lobiani* (ham)**

Traditional bean-baked bread filled with bean puree. The dough is made using a fermented milk-based product, *matsoni*. This type of *lobiani* has also ham in the filling.

***Lobiani* (traditional)**

Traditional baked bread filled with bean puree. The bread is made from flour, yeast, salt, water, milk/or milk-based products (such as sour cream or *matsoni*), butter, egg, salt and yeast.

Loose cake

Made of flour, sugar, egg, oil or margarine and raisins. Sometimes other ingredients are added, such as fruit (apple) or sour cream – *matsoni*.

Pizza

Savoury pie (filled with meat)

Savoury pie (filled with potato)

Shawarma

Dish made of shawarma meat (in Georgia usually pork, chicken or their mixture, sometimes with lamb or mutton), chopped or shredded vegetables, pickles and assorted condiments in a flour wrap.

Sweet puff pastry

Examples of industrial street foods collected in Tbilisi, Georgia

Baked biscuits | **Chips** | **Chocolate** | **Cookies** | **Crackers**

Croutons | **Salty sticks** | **Sunflower seeds (salted)** | **Tea biscuits** | **Wafers**

Annex 2. List of interviewers

Maia Beruchashvili MD, NCD Department

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Tamar Chachava MD, NCD Department

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Ana Papaskiri, NCD Department

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The WHO Regional Office for Europe

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

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