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The food environment in cities in eastern Europe and Central Asia – Kazakhstan

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Abstract

This technical report presents results from the FEEDcities Project – Eastern Europe and Central Asia, a cross-sectional survey conducted in Almaty, Aktau and Kyzylorda, Kazakhstan, between July and August 2017, to evaluate the local street food environment. It characterized the vending sites, the food offered and the nutritional composition of the industrial and homemade foods available in these settings. The policy implications of the findings are outlined.

The study was conducted within a bilateral partnership between WHO and the Institute of Public Health of the University of Porto, in collaboration with the Faculty of Medicine, the Faculty of Nutrition and Food Sciences and the Faculty of Pharmacy of the University of Porto (WHO registration 2015/591370 and 2017/698514). The study was funded through a biennial collaborative agreement and joint programmes between the Government of Kazakhstan and United Nations agencies in Kazakhstan for Kyzylorda and Mangystau oblasts, a voluntary contribution by the Ministry of Health of the Russian Federation and the *Resolve to Save Lives* project of Bloomberg Philanthropies.

Keywords

STREET FOOD
READY-TO-EAT FOOD
NUTRITIONAL COMPOSITION
TRANS-FATTY ACIDS
SODIUM
POTASSIUM
FOOD ANALYSIS
KAZAKHSTAN

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Abbreviations and acronyms

FAO	Food and Agriculture Organization
NCD	noncommunicable disease
TFA	*trans*-fatty acids
WHO	World Health Organization

Glossary[1]

Ayran	fermented beverage made from sheep's milk, with salt
Baursak	fried puffy bread
Belyashi	small meat pie
Chebureki	fried savoury pastry generally filled with ground or minced meat and onions
Doner kebab	seasoned meat stacked in the shape of an inverted cone turned slowly in front of a heat source
Dukoni	restaurant serving traditional fast-food selling directly on the street through an open window
Jent	dessert made of a hard grain like millet, soaked in sugar and oil
Kebab	grilled meat, often on a skewer
Kefir	fermented milk drink made with a yeast or bacterial fermentation starter of *kefir* grains
Keksi	muffin
Kompot	beverage obtained by cooking fruit in a large volume of water, often with sugar or raisins
Kozhe	cold drink made by boiling rice, millet or pearl barley with a mixture of dairy products such as *ayran* or *kefir*. Additional ingredients include salt, water, milk or meat.
Kumis (kumys)	fermented dairy product made from mare's milk (low alcohol content)
Kvas	fermented beverage made from rye bread
Kurt (kurut)	salty snack made by straining and drying sour milk or yoghurt
Lagman	noodle dish made of chopped peppers and other vegetables, served in a spicy, vinegary sauce
Lepyoshka	flatbread
Pirozhki	baked yeast pastry commonly stuffed with meat (typically beef) and/or vegetables
Pirozhnoe	cake
Plov	rice cooked in a seasoned broth with a mixture of spices, vegetables and other ingredients, such as meat, fish and/or dried fruit
Pryaniki	gingerbread
Samsa (sambusa, samosa)	baked puff pastry usually filled with ground meat (lamb, beef or chicken) and vegetables
Shashlik	skewered grilled cubes of meat, alone or with alternating pieces of meat, fat and vegetables (e.g. bell pepper, onion, mushroom, tomato)
Shubat	fermented camel's milk

1 Many of these foods and drinks are illustrated in annexes 1 and 2.

Executive summary

This report provides an overview of the street food context in Almaty, Kazakhstan, and of the nutritional composition of street food sold in Aktau and Kyzylorda, analysed with a standard method. The results are both positive and of concern, indicating that health promotion in the country should be strengthened.

The Food and Agriculture Organization of the United Nations (FAO) and World Health Organization (WHO) define street food as "ready-to-eat foods and beverages prepared and/or sold by vendors and hawkers especially in streets and other similar places". In many settings, especially in urban areas in low–middle-income countries, street food is diverse and constitutes a widely accessible, inexpensive source of nutrition, although it often includes energy-dense foods rich in fat, sugar and sodium. Previous research on street food has focused primarily on its safety and not on its nutritional contribution to the diet. Furthermore, little or no research has been conducted in the WHO European Region.

The main objective of the FEEDcities Project – Eastern Europe and Central Asia is to characterize the street food environment in cities in those regions. This study provides information for achieving the objectives of the WHO European Food and Nutrition Action Plan 2015–2020, such as creation of healthy food and drink environments and extending surveillance, monitoring, evaluation and research. The report characterizes the vending sites, the food offered and the nutritional composition (*trans*-fatty acids [TFA], sodium and potassium) of the street foods most commonly available in Almaty, the largest city in Kazakhstan, and in Aktau and Kyzylorda.

Between July and August 2017, street food vending sites in the public markets of Almaty were identified by random and systematic sampling procedures. Vending sites that sold only unprepared fresh fruit were not eligible. Ten public markets were selected, in which 384 eligible vendors were interviewed and 120 food samples collected and analysed. Four samples were collected of each of the 30 most commonly available foods (20 homemade and 10 industrial). From the list of the most frequently available street foods in Almaty, the 10 most common homemade and the 5 most common industrial foods were collected in Aktau and Kyzylorda. Street food products were grouped as fruit (fresh or dried), beverages (any drink, alcoholic or non-alcoholic) and food other than fruit. Foods other than fruit and beverages were classified as homemade (cooked and/or prepared at home or on the street) or industrial (produced by the food industry).

In Almaty, most of the street food vending sites were stationary (92.7%). The vendors were usually women (74.2%) and employees (67.2%). Generally, food was sold at stationary sites on 6 days a week (94.7%), throughout the year (91.0%), regardless of the weather (90.1%). A wide variety of foods was observed, indicating a rich street food culture. Fruit was sold by only 1.0% of vending sites (mobile: 0.0%; stationary: 1.1%), while food other than fruit was available at 92.7% of sites (mobile: 82.1%; stationary: 93.5%) and beverages at 47.4% (mobile: 57.1%; stationary: 46.6%). Water, soft drinks and traditional beverages were sold at over 50% of vending sites that sold beverages. Most of the stationary vending sites that sold food other than fruit sold only homemade foods (54.4%), followed by those that sold exclusively industrial foods (36.6%) and those that sold both (9.0%).

High levels of TFA and sodium were found in the most commonly available foods. In Almaty, the mean TFA content per average serving was highest for homemade *pirozhnoe* (3.20 g), industrial wafers (1.98 g) and homemade *shashlik* (1.87 g) corresponding to 144.3%, 96.1% and 84.5% of the recommended maximum daily intake (reference daily intake, 2000 kcal for an average adult). In Aktau, the highest mean TFA content per serving was found in industrial wafers (1.77 g) and biscuits (0.94 g), corresponding to 79.9% and 42.7% of the recommended maximum daily intake, respectively. In Kyzylorda, the mean TFA content per serving was also highest for industrial wafers (5.05 g) and for homemade *doner kebab* (0.75 g), corresponding to 227.1% and 34.0% of the recommended maximum TFA daily intake.

In Almaty, the highest mean sodium content per serving was found in homemade *lagman* (2248 mg), *plov* (2084 mg) and *doner kebab* (1707 mg), corresponding to 112.4%, 104.2% and 85.4% of the recommended maximum daily intake. Similar results were found in Aktau and in Kyzylorda. In Aktau, the highest mean sodium content per serving was found in *doner kebab* (1425 mg) and *kurt* (791 mg), corresponding to 71.2% and 39.6% of the recommended maximum daily intake. In

Kyzylorda, the highest sodium contents were found in homemade cabbage salad (2090 mg) and *doner kebab* (1532 mg), corresponding to 104.5% and 76.6% of the recommended maximum daily intake for this nutrient.

The mean potassium content per serving in Almaty was highest in *doner kebab* (1327 mg), *lagman* (964 mg) and *plov* (571 mg), corresponding to 37.8%, 27.5.0% and 21.6% of recommended minimum daily intake. In Aktau, the mean potassium content per serving was highest in homemade *doner kebab* (954 mg) and industrial chips (780 mg), corresponding to 27.2% and 22.2% of the recommended minimum daily intake. In Kyzylorda also, homemade *doner kebab* had the highest mean potassium content (891 mg), with cabbage salad (490 mg), corresponding to 25.4% and 13.9% of the daily recommended minimum potassium intake.

These results suggest that there is room for improvement in the culinary practices and ingredients used by street food vendors in Kazakhstan. Cooking fats and pastry shortening containing TFA appeared to be widely available and were used at all three sites. Most of the traditional homemade dishes analysed had a high sodium content, indicating that excess salt is added. This finding was consistent at the three study locations. Preservation of traditional recipes is of extreme importance, as the results also show that the most popular street foods sold in Kazakhstan contain a range of vegetables, which are some of the richest sources of potassium.

Excluding vending sites that sell exclusively fruits, it was shown that fresh fruit was less common than other food or drinks. Increasing the availability of fruit could ensure that urban residents have ready access as an essential part of a healthy diets. The types of drinks offered in Almaty could also be improved, as could the nutritional composition of the street foods sold. The wide availability of sugary soft drinks is notable and is a concern in light of the increasing rates of overweight and obesity in the country.

Strategic thinking is required to improve the nutritional quality of street foods available in Kazakhstan while at the same time protecting the cultural and community role of market vendors in sustaining traditional diets and providing access to whole foods such as fruit and vegetables. Several policy options are available that could result in a healthier street food environment. These should be integrated into national policies, such as the national noncommunicable disease (NCD) programme, in order to strengthen promotion of healthy diets and prevention of diet-related NCDs.

Reducing the salt and TFA content of ready-to-eat foods sold at street vending sites will require a multi-pronged approach. One aspect would be health promotion among street food vendors to convince them to add less salt and to use healthier fats and oils. Awareness should also be raised among the public that these foods may harm their health if eaten in excess. Furthermore, maximum limits should be set for salt and TFA in foods. As a member of the Eurasian Economic Union, Kazakhstan has already adopted a regulation on the levels of fats and oils in food products, as part of a commitment to limit the availability and use of TFA in food products by the end of 2018. This study shows that there is some way to go to achieving compliance, and continuous monitoring will be necessary after the 2018 deadline. A final aspect would be to improve the labelling of packaged foods to ensure the provision of nutritional information, so that all products bear both a nutrient declaration and an ingredients list.

1. Introduction

Kazakhstan is a landlocked country in Central Asia. It is an upper middle-income country with an annual gross domestic product of US$ 137.3 billion and an annual growth of 1.1% *(1)*. The population is about 18 million people *(1)*, of whom 1.8 million are concentrated in Almaty, the largest city in the country and the former capital *(2)*. The poverty rate (which reflects the threshold for a person's minimum needs for nutrition, clothing and shelter) has decreased steeply since 2001, from 14.8% to 0.3% in 2015 *(1)*. Approximately 53% of Kazakhs live in urban areas *(1)*. The country has seen a slight increase in the rate of population growth (1.4% in 2016) *(1)*, and 25.9% of the population is aged under 15 years and 7.7% ≥ 65 years *(3)*. Life expectancy at birth is estimated at 72.7 years *(1)*.

Cardiovascular disease is the leading cause of death in Kazakhstan, accounting for 54% of all deaths, followed by cancer (15%) and other NCDs (10%) *(4)*. Overweight and obesity affect 60.7% and 26.5% of the adult population (> 20 years) *(5)*. The prevalence of overweight and obesity among males and females ≥ 15 years of age in 2014 was 53.1% and 21.8%, respectively *(6)*. The country has one of the highest rates of premature mortality in the WHO European Region, at 648.31 per 100 000 population aged 30–69 years in 2012. Nevertheless, there is an overall downwards trend, similar to the rest of the Region *(7)*. The prevalence of overweight and obesity among children < 19 years in 2014 was 9.2% and 5.5%, respectively *(6)*. In a study of the prevalence of childhood obesity and behavioural and environmental factors among primary schoolchildren (8–10 years of age) in Kazakhstan, conducted for the fourth round of the WHO Childhood Obesity Surveillance Initiative in 2015–2016, the prevalence of overweight was 18.8% in boys and 19.4% in girls, and 6.5% of boys and 5.5% of girls were obese. The prevalence of overweight and obesity was significantly higher among urban than rural boys. The prevalence of daily consumption of fruit (33.1%) and vegetables (30.2%) was low. About one fourth (22.5%) of children drank carbonated soft drinks with added sugar on ≥ 4 days/week. Furthermore, these drinks were available in buffets and canteens in 43.8% of the schools surveyed; sweet food such as sweets, chocolate bars and others were available in 63.5% of schools; and salty or spicy foods such as chips, popcorn, peanuts were available in 18.4% *(8)*.

Central Asian countries in the WHO European Region have experienced a nutritional transition in recent decades, reflecting growing urbanization and the globalization of the processed food supply chain *(9)*. The associated dietary changes include 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 *(10)*, which are known to be associated with weight gain and a greater frequency of NCDs. In particular, there is consistent evidence that TFA and sodium in industrially produced foods increase the risk of cardiovascular diseases *(11)*. WHO is advocating for complete elimination of TFA from the global food supply *(11, 12)*, and public health authorities in several countries are initiating effective bans or regulations on their use *(13)*. WHO has also called for a significant reduction in sodium intake *(14)*. Most dietary intake of sodium is either from addition of salt during preparation and cooking of food or from processed foods. Salt reduction initiatives are based on product reformulation, public awareness and clear rules for product labelling *(14)*. WHO recommends a level of ≤ 2000 mg of sodium 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 disease *(15)*. Nevertheless, in most countries for which recent data are available, the dietary sodium intake is much higher *(16)*. In 2010, the average daily intake of salt in Kazakhstan was 5.98 g *(17)*. 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 disease *(18)*.

NCDs are a major threat to the socioeconomic well-being of populations. While there is political commitment to improve health in Kazakhstan, the lack of representative surveys of nutritional status, dietary habits and food composition is a barrier to setting specific health and nutrition policies *(7)*. Data for 2011 indicated that the national daily consumption of fruit (195 g) and vegetables (241 g) was lower than the European average in the same period (285 g and 318 g, respectively) *(7)*. A programme for the prevention and control of NCDs 2016–2020 is being implemented. One of the objectives is to ensure a healthy lifestyle, with smoking cessation, decreased alcohol consumption, increased physical activity and a healthy diet. Several strategies are being designed to improve health literacy and promote behaviour change at several levels, including municipalities and regions *(7)*. Unhealthy diets have been identified as a major risk factor for NCDs in the country *(19)* and are being addressed in the political agenda of Kazakhstan.

FAO and WHO define street foods as "ready-to-eat foods and beverages prepared and/or sold by vendors or hawkers especially in the streets and other similar places" *(20)*. Street food is a cultural, social and economic phenomenon typical of urban areas, where the lifestyle is more sedentary and the time dedicated to cooking at home is dramatically reduced *(21)*. Street food may be an important component of the daily diet, particularly in countries where there are few supermarkets and shops *(22)*. It also has an important community role, by supporting access to high-fibre foods rich in micronutrient (fruits and vegetables) and by protecting traditional foods and diets. Nevertheless, foods purchased from street vendors may also contribute significantly to excess intake of energy and nutrients; however, this aspect has received little attention *(23)*. The urban street food environment can be expected to reflect the dietary habits of the population but can also influence dietary patterns. This highlights the importance of characterizing and monitoring street food offer and purchasing in the context of the prevention of NCDs; however, research in low–middle-income countries has focused mainly on hygiene and food security *(23)*, and little is known about the nutritional characteristics of street food.

Street food in Kazakhstan

Street trade is a well-developed activity in this region of the world, with food commonly sold in typical Central Asian bazaars. In Kazakhstan, food preferences and gastronomy reflect the country's nomadic traditions and the multicultural background of people who travelled the Silk Road *(24)*. As in other street food environments, although traditional foods are likely to be widely available, foods processed by large-scale food manufacturers are becoming important as ingredients and as final products *(25)*. Unlike in some other countries where research on street food has been conducted *(26)*, in Almaty, most street food vendors operate semi-static or stationary vending units in city markets or their vicinity. These include open-air restaurants selling cooked food directly on the street; *dukoni* vending sites, with food sold through windows; vendors moving around with carts, trays or bags of food; fast-food sites; and stands where pancakes and donuts are prepared on site. Several of the markets in Almaty are very large, sometimes with 100–150 vendors. Commonly available foods include traditional homemade foods, diverse savoury and sweet pastries, many types of bread, *kebabs* and grills, various fermented milk foods (e.g. *kurt*) and drinks (e.g. *ayran*) and a type of cold soup, *kozhe*. Ice cream and popcorn were sold at small stands on the outskirts of the markets.

As described previously, the nutritional composition of street foods is usually highly variable because of differences in culinary practices and ingredients, even in the same setting *(27)*. Hence, as Kazakhstan is a large country, divided into regions with different characteristics, we decided to analyse the nutritional composition of street foods in Almaty and also in two cities in distinct regions: Aktau and Kyzylorda.

Objectives of the study

The main objective of this study was to characterize the street food environment of urban Kazakhstan. The specific objectives were to describe the characteristics of street food vending sites and the street food offered at selected vending sites in Almaty and to assess ready-to-eat foods sold in the street (other than fruit) in Almaty, Aktau and Kyzylorda for their sodium, potassium and TFA contents.

2. Methods

A cross-sectional evaluation of street food was conducted in Almaty, Aktau and Kyzylorda between 24 June and 29 August 2017. The study protocol was developed at the University of Porto with the WHO Regional Office for Europe and approved by the Ethics Committee of the Institute of Public Health of the University of Porto. Staff and consultants from the WHO Regional Office for Europe recruited and trained seven local field researchers in a 4-day workshop. The training included lectures, demonstrations, practice interviews and testing of the form for data collection in the office and in a pilot study in a city market that was not selected for the study.

Street food vending sites and food offered

Eligibility criteria

The definition of street food used was that proposed by FAO and WHO, "ready-to-eat foods and beverages prepared and/or sold by vendors or hawkers especially in the streets and other similar places" *(20, 28)*. It includes prepared (e.g. sandwiches, salad) and cooked (e.g. boiled eggs, traditional dishes) products, as well as raw foods for immediate consumption (e.g. fruits, nuts), although these products may be bought to be eaten later.

Eligible vending sites were those that sold ready-to-eat food, including beverages and/or snacks, from any venue other than a permanent establishment with four permanent walls not selling directly to the street, operating in a predefined perimeter. They included "street hawkers" or mobile vendors as well as sellers with semi-static or stationary vending units. Vending sites that sold exclusively unprepared fresh fruit were not eligible.

Sampling of vending sites

As we observed that most vending sites were concentrated in markets and their surroundings, we started by identifying all public markets in Almaty (Table 1) from information provided by local authorities and collected during the preliminary field visit. Ten public markets were selected randomly from 23 that were identified, corresponding to about 50% of the markets in Almaty. The sample included markets in six districts of Almaty (Almalinsky, Auezovsky, Bostandyksky, Medeusky, Turksibsky and Zhetususky), of which five were small, two medium-sized and three large. For each of the selected markets, we defined a 500-m buffer zone around its centroid as the study area. The markets were evaluated on consecutive days in the following order: Yarmarka Bereke, Nikolskiy, Green Bazaar, Optovka, Sary Arka, Kazakhfilm, Yarmarka Turkibsky, Ak Bulak, Aynabulak and Rynok Almaty 1.

Table 1. Markets that sell ready-to-eat food in Almaty

Market name*	District	Address	Size
Green Bazaar	Medeusky	Zhibek-Zholi 53	Large
Optovka	Almalinsky	Rozyibakiyeva 33/1	Large
Altyn Orda	Nauryzbaysky	Rayimbeka Prospekt	Large
Barakholka	Alatausky	Severnyoe Koltso	Large
Tactak	Almalinsky	Tole Bi 266	Large
Rynok Almaty 1	Turksibsky	Sholokhova Street	Large
Yarmarka Turksibsky	Turksibsky	Suyunbaya 261	Medium
Bazaar on Kamenke	Nauryzbaysky	Dzhandosova Street	Medium
Arystan	Auezovsky	Zhybanova 20b	Medium
Sary Arka	Auezovsky	4th Micro-Rayon Altynsarina	Medium
Vernensky*	Medeusky	Mendeleev 59	Medium
Mekhrinisa	Turksibsky	Seyfulivna 182	Medium
Altai*	Turksibsky	Namaganskaya 51	Medium
Syr Darya	Auezovsky	Otegen Batyra 60	Small
Yarmarka Bereke	Almalinsky	Muratbayeva 95	Small
Nikolskiy Bazaar	Almalinsky	Baytursyinova	Small
Ak Bulak	Turksibsky	Seyfulivna 174	Small
Kazakhfilm (Almaty 1)	Bostandyksky	Mikro-Rayon Kazakhfilm, 6	Small
Karasu	Bostandyksky	Rosybakiyeva/Satpayeva	Small
Ayan	Turksibsky	Mikro-Rayon Aynabulak, 97	Small
Mini Altai*	Turksibsky	Maylina 13	Small
Aynabulak	Zhetususky	Mikro-Rayon Aynabulak 1, Muktayeva Street 1	Small
Aksay	Auezovsky	Tole Bi, corner of Momyishuli	Small

Selected markets are highlighted in bold.
* These markets were initially selected, but replaced by the nearest market because of constraints: the Vernensky and Altai markets had few eligible vending sites (one and five, respectively) and were replaced by the Yarmarka market and by the Rynok Almaty 1 market, respectively. The Mini Altai market was closed at the time of data collection and was replaced by the Aynabulak market.

On the assumption that the nutritional composition of street food in Kazakhstan might differ by region, culinary practices and/or ingredients, we also collected food samples in Aktau and Kyzylorda. As in Almaty, we selected a predefined number of markets (four) in each city from a list provided by the local authorities (Table 2).

Table 2. Markets that sell ready-to-eat food in Aktau and Kyzylorda

Aktau	Kyzylorda
Yellow market (Sary market)	**Zhana bazaar**
Ruskaz market	Aitbek market
Olja	Azan market
Ak bazaar	Sybaga market
Volna	**Talgat market**
Masat	**Ak tore market**
Prokurorskiy market	Agzhan market
Magash	**Zhaina market**
Rid	
Zaman	
Vostochnyy*	
Asar-s	

Selected markets are highlighted in bold.
*This market was initially selected but was replaced by the nearest market (Volna) because it was shut at the time of the study.

In Almaty, field researchers, operating in pairs, canvassed each study area to find street food vendors. They accessed the market by the main entrance and walked through any publicly accessible street in the selected area. After canvassing the whole market, they moved to the surroundings of the study area. After registering the GPS coordinates of each vending site, they approached the vendors and explained the study objectives and procedures. Then, they asked for general consent to participate in data collection. When the vendor agreed, the interviewers administered the structured questionnaire (approximately 10 min) on the vending activity and the food offered. In markets with more than 100 eligible sites, an average of one in every two was evaluated, although all vending sites were mapped. Of 816 eligible street food vendors and 396 approached, 384 agreed to participate (97.0% participation).

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 with the permission of the vendor. The field researchers were instructed to answer any questions the vendors might have about the purposes of the study and to distribute leaflets with the study description.

Characterization of the vending sites and food offered

The data collected, by direct observation and face-to-face interviews with vendors who agreed to participate, included some characteristics of the vendors (e.g. sex and ownership), the vending site (mobile or stationary), the physical setup of stationary vending sites (e.g. stand, van, freezer machine) and activity (e.g. working days, number of employees, access to clean water and electricity). Data on the foods offered were also collected (e.g. type of food product, size of portions, preparation and packaging).

Foods were grouped according to their nature into fruit: fresh or dry; food other than fruit: all other food other than fruit and beverages; and beverages: any alcoholic or non-alcoholic drink. Foods other than fruit and beverages were further classified as homemade (cooked and/or prepared at home or on the street, even with industrial ingredients) or industrial (produced by the food industry and sold with no further preparation). Beverages were classified into: soft drinks, water, fruit juice-based drinks, fresh fruit juice, milk, alcoholic beverages, energy drinks, coffee, tea and others.

Collection and analysis of street foods

Selection and collection of food samples

In Almaty, the 20 most frequently available homemade foods, including traditional beverages of unknown composition, and the 10 most frequently available industrial foods were selected for bromatological analysis. Common drinks of known nutritional composition, such as coffee, tea, milk and soft drinks, were not eligible. A total of 120 samples were collected, corresponding to four samples of each of the 30 foods. The samples collected corresponded to one unit or the usual dose sold. For any type of food sold in small portions (e.g. small snacks, biscuits), each sample comprised more than one unit of the same food, according to the usual purchasing or consumption pattern. Examples of one of each of the 30 food samples collected in Almaty are shown in the annexes.

For sampling, the selected homemade foods were grouped into sets of three or four foods (A, B, C, D, E and F), while industrial foods were grouped into sets of two or three (G, H, I and J), each collected at four different vending sites (Table 3). On 5 consecutive days (Monday to Friday), food samples in four or five sets of homemade and three or four sets of industrial foods were collected each day in two markets, in the order shown in Table 4. Each day, approximately 24 samples of different foods were collected, until 120 samples had been reached.

Table 3. Definition of food sample sets in Almaty

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 4. Framework for random sampling of food products in *Almaty*

Day	Market	Homemade			Industrial	
1	Aynabulak	C	D	E	G	H
	Almaty 1	F			I	J
2	Green Bazaar	A	B	C	G	
	Nikolskyiy	D	E		H	I
3	Kazakhfilm	B	C		J	G
	Sary-Arka	E	F	A	I	
4	Yarmarka Turksibsky	D	E		H	I
	Ak- Bulak	F	A	B	J	
5	Yarmarka Bereke	F	A		J	G
	Optovka	B	C	D	H	

The vending sites at which food samples were collected were selected by random route procedures, starting with random selection of GPS coordinates in each study area. These were used as the starting point for systematic selection, in which the researchers moved north and then clockwise to the east, continuing through the south and the west, to the limits of the study area or a physical barrier (e.g. wall, canal), until a vending site was found at which the selected foods were available. In each market and on each day of collection, only one food sample was obtained from the same vendor, the most common foods being selected first.

In Aktau and Kyzylorda, the 10 most frequently available homemade foods and the five most frequently available industrial foods in Almaty were collected for analysis. A total of 30 samples were collected in each city (60 samples), corresponding to two samples of each of the 15 foods identified. As in Almaty, the food samples collected corresponded to one unit or the usual dose sold. For any type of food sold in small portions (e.g. small snacks, biscuits), each sample comprised more than one unit, according to the usual purchasing or consumption pattern. For sampling, the selected foods were grouped into six sets of homemade foods (A, B, C, D, E and F) and five sets of industrial foods (G, H, I, J and L), each collected at two different vending sites (Table 5). For 4 consecutive days, samples of five sets of homemade and two to four sets of industrial foods were collected in one market, in the order shown in Table 6. Each day, seven to eight samples of different foods were collected in each city, until 30 samples had been collected (Table 6).

Table 5. Food sample sets in Aktau and Kyzylorda

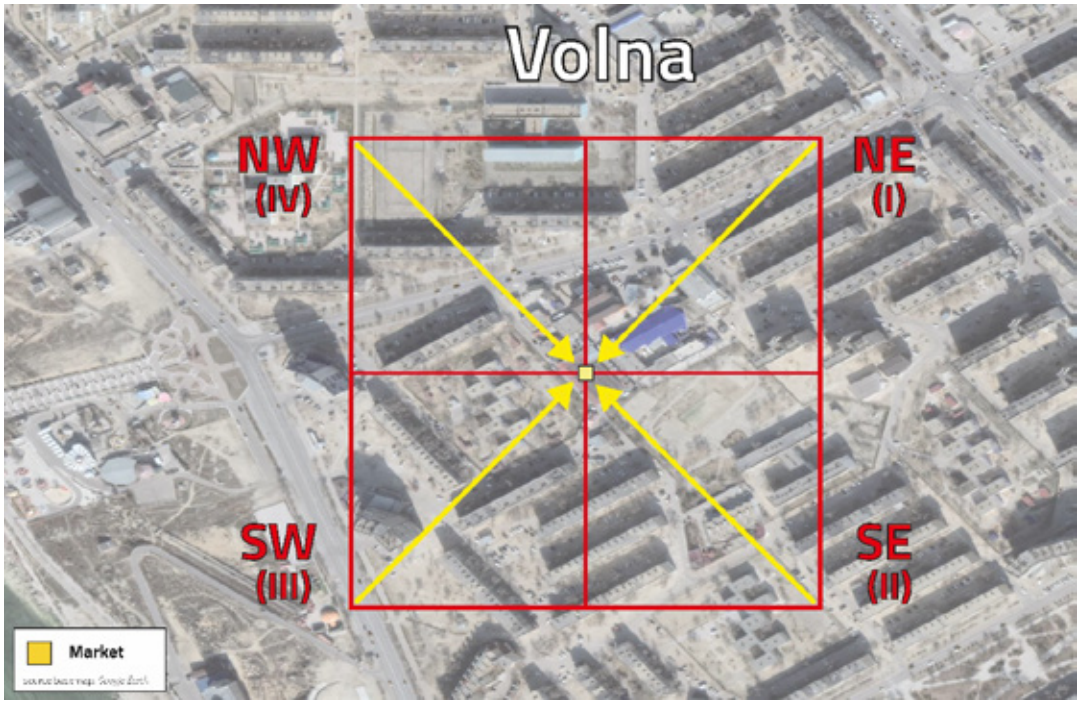
Homemade food	Set	Industrial food	Set
1	A	1	G
2		2	H
3	B	3	I
4		4	J
5	C	5	L
6	D		
7			
8	E		
9			
10	F		

Table 6. Framework for random sampling of food products in Aktau and Kyzylorda

Day	Market	Section I		Section II		Section III		Section IV	
1	A	A	G	A	H	B	I	B	C
2	B	F	E	I	E	J	D		D
3	C	A	H	A	C	B	G	B	L
4	D	D	L	D		E	F	E	J

Before collecting food samples in Aktau and Kyzylorda, the researchers identified the limits at four cardinal points of each market: NE, SE, SW and NW. From each point to the centre, the buffer zone of the market was divided into four sections (I, II, III and IV) of approximately the same area, as depicted in Fig. 1. Each day, all four sections of each market were canvassed, starting with vendors at the limit of the buffer zone towards the centre, in the following clockwise order: NE, SE, SW and NW. The starting point in each section was the limit previously identified, and the centre that at which the four areas converged.

Fig. 1. Example of method used to collect food samples in Aktau and Kyzylorda (*Volna* market, Aktau)



In each section, researchers looked for eligible vendors to purchase the foods allocated for that section. Only one homemade and one industrial food were purchased from the same vendor. If the product was not available at the vending site, the next product on the list for the day was bought, until one of the products was found. If no selected product was sold, the researchers looked for the closest vending site, following a random route: north, obstacle, clockwise. This strategy was stopped if the product was not found at 10 eligible vending sites on the route, and the researchers moved to the next area. The same strategy was used if a selected vending site was closed or the vendor was not present that day.

After purchase of the designated foods in one section, at the corresponding vending site or at one of the 10 vending sites on the random route, the researchers moved to the next section. If a product was not found anywhere in the market (sections I–IV), it would be sought the following day or at the next market. The next day, the same strategy was followed, but, as soon as the product that was missing the previous day was identified, it was purchased, and the strategy was followed for the remaining products.

Processing of food samples

In all three cities, four representative aliquots of each sample were homogenized, weighed and packed individually in labelled rigid plastic containers. Solid and semi-solid foods were previously ground mechanically. After packaging, each container was weighed again and stored in a freezer at –18 °C) until bromatological analysis. Before analysis, samples were defrosted, the total weight compared to detect moisture loss during storage and shipping, homogenized and immediately analysed for moisture. The bromatological analysis included determination of TFA, sodium and potassium. For TFA analysis, the fat fraction was extracted with organic solvents, converted to fatty acid methyl esters, as described elsewhere *(29)* and a portion used for separation by gas chromatography. Sodium and potassium were analysed by flame photometry according to the method of Vieira et al. *(30)*.

Statistical analysis

The street food environment in Almaty was characterized, overall and in districts and markets by descriptive statistics. The location of the vending sites was mapped, and the characteristics of the vending sites and the food offered were presented as proportions. The results for the nutritional composition of each food are presented as means and ranges for TFA, sodium and potassium per serving and as the mean proportion of the recommended intake. Mean serving sizes, calculated as the mean of the individual portion of each food collected, are also presented.

3. Results

Distribution of selected markets and vending sites

Fig. 2 shows the distribution of the selected markets and street food vending sites in Almaty. Figs 3–12 represent the 500-m buffer zones of each market and the vending sites identified in each study area. Within each market, the distribution of vending sites depended on the configuration and type of market, from predominantly concentrated in specific market sections, as in the Ak Bulak, Kazakhfilm and Yarmarka Bereke markets, to more scattered, as in the Aynabulak, Rynok Almaty 1, Yarmarka Tukibskiy, Green Bazaar, Optovka, Nikolskiy and Sary Arka markets.

Figs 3 and 4 show the distribution of the markets in Aktau and in Kyzylorda, which were scattered throughout the cities.

Fig. 2. Selected markets and street food vending sites in Almaty

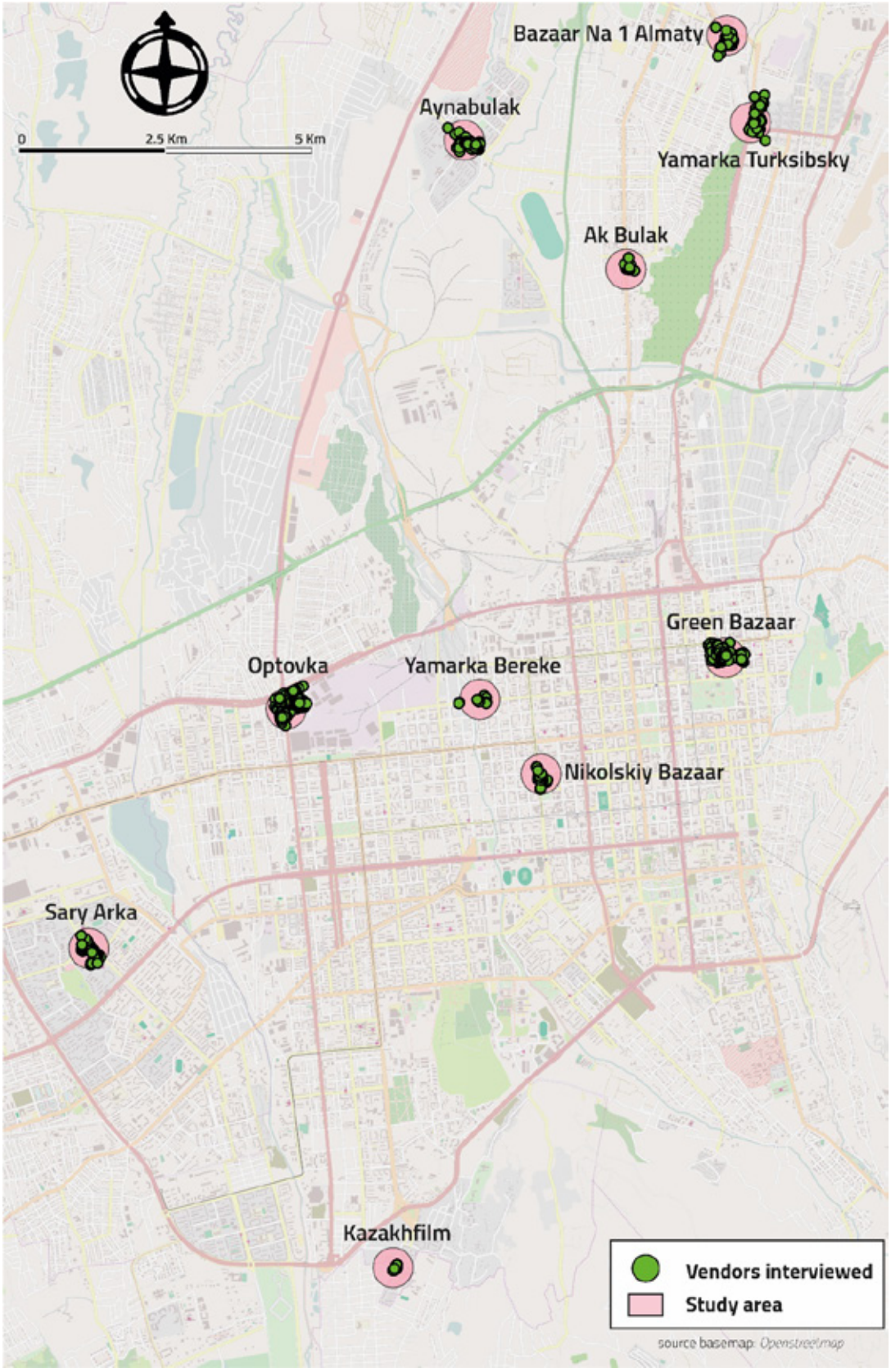


Fig. 3. Yarmarka Bereke market buffer zone and street food vending sites evaluated

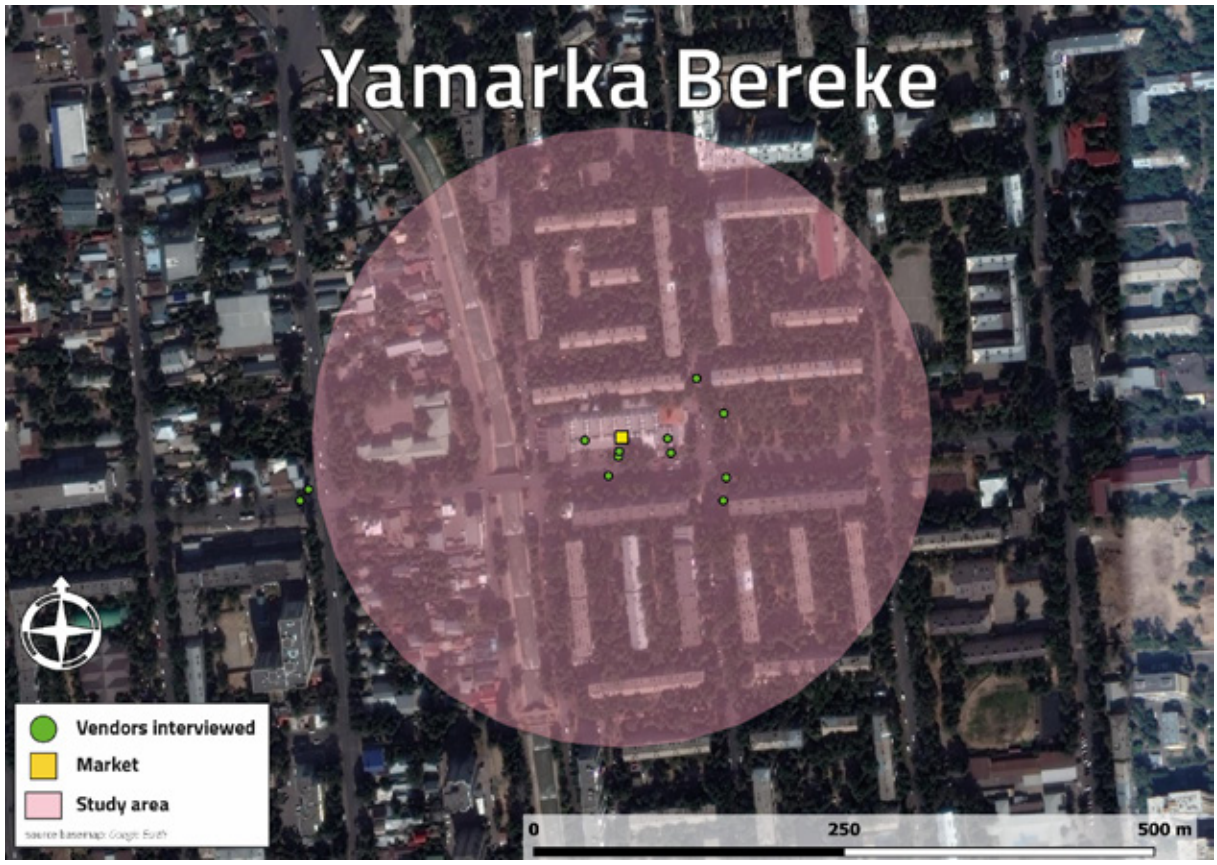


Fig. 4. Nikolskiy market buffer zone and street food vending sites evaluated

Fig. 5. Green Bazaar market buffer zone and street food vending sites evaluated

Fig. 6. Optovka market buffer z=one and street food vending sites evaluated.

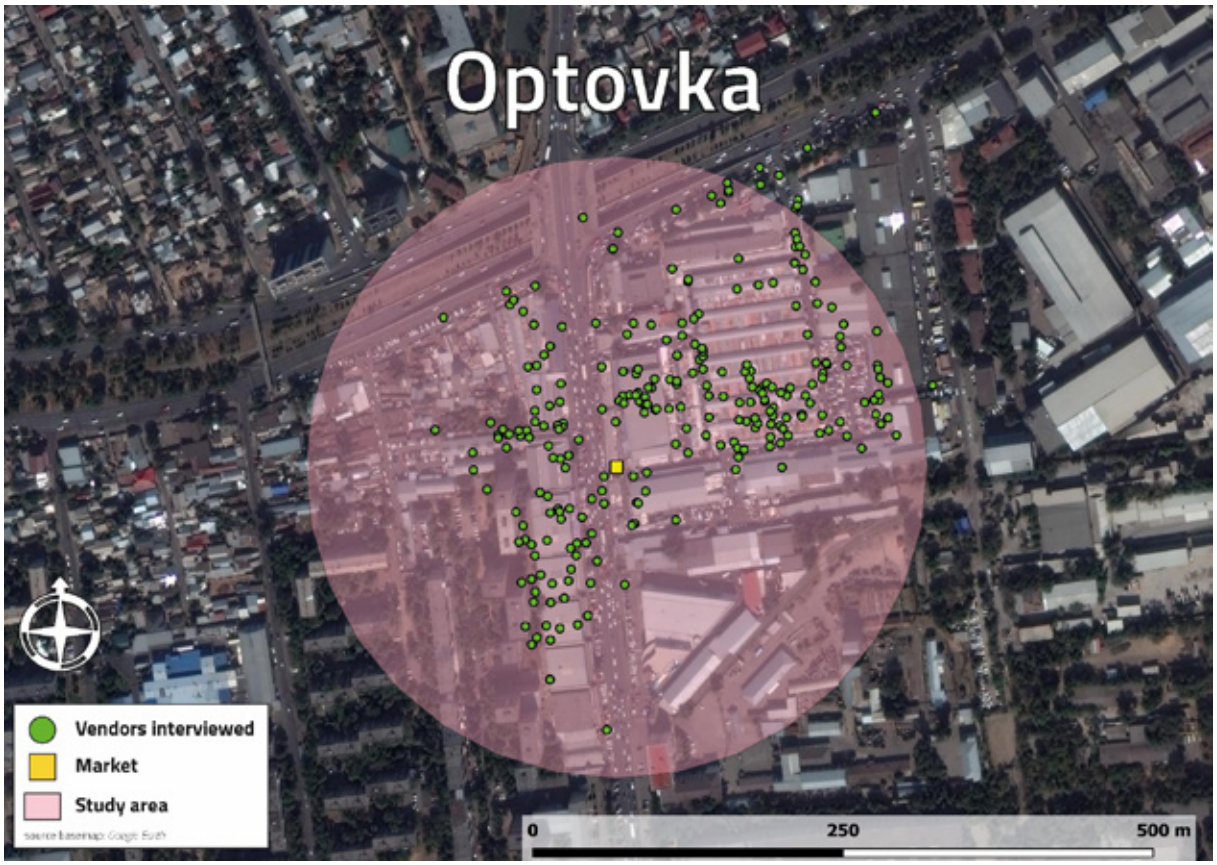


Fig. 7. Sary Arka market buffer zone and street food vending sites evaluated

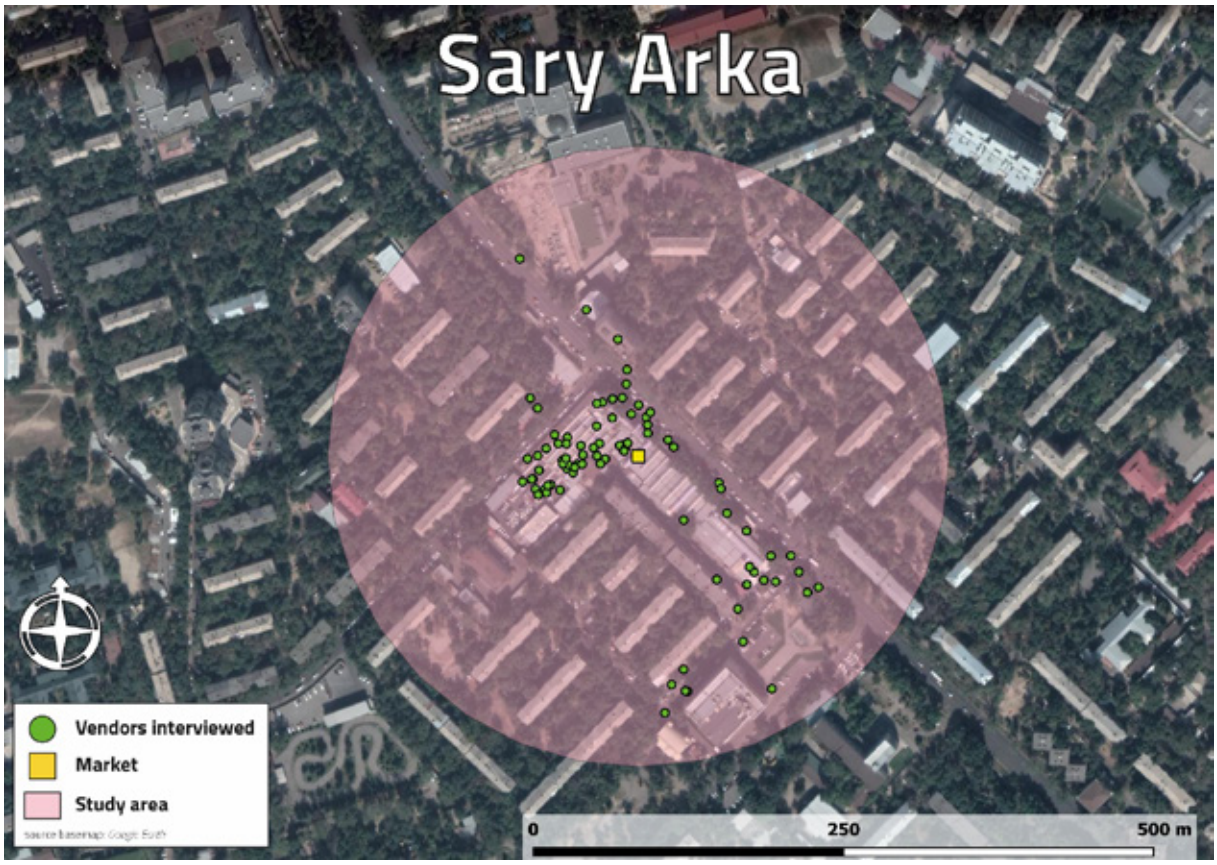


Fig. 8. Kazakhfilm market buffer zone and street food vending sites evaluated

Fig. 9. Yarmarka Turkibsky market buffer zone and street food vending sites evaluated

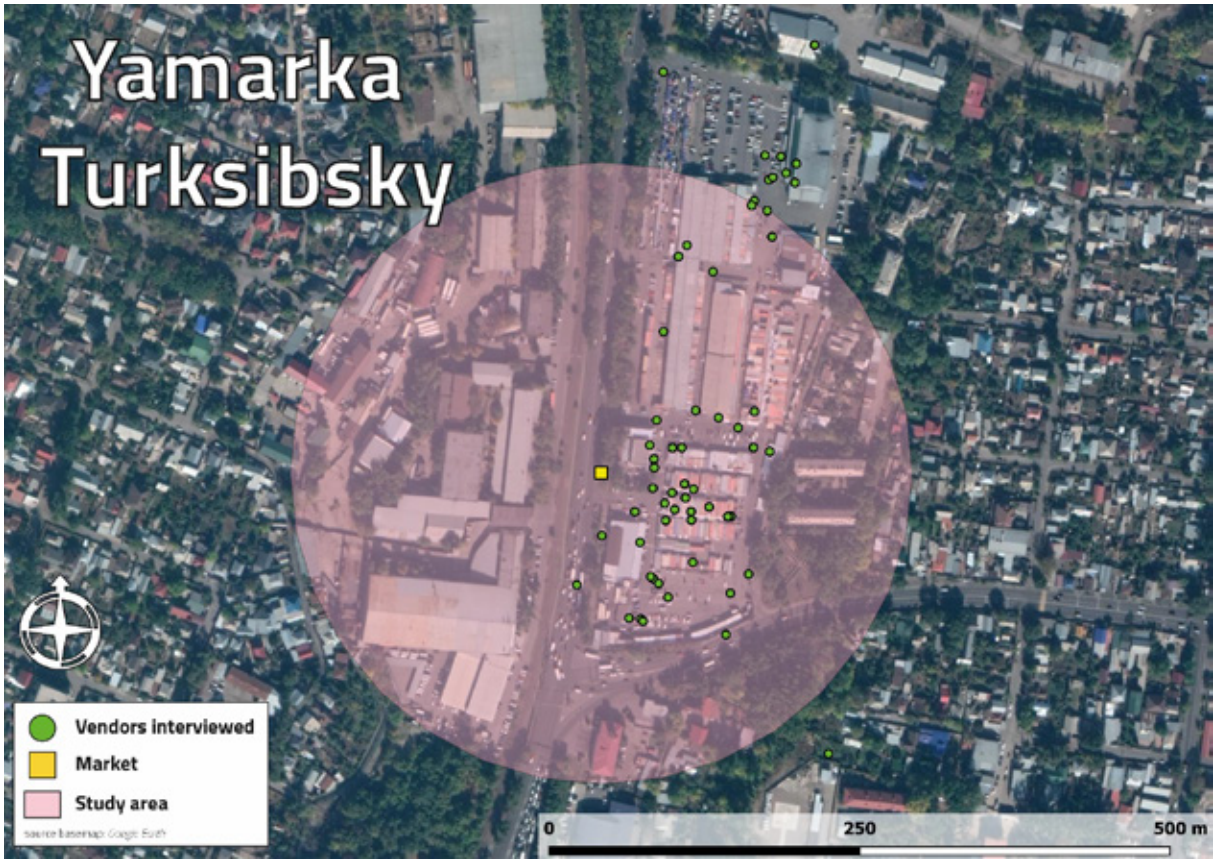


Fig. 10. Ak Bulak market buffer zone and street food vending sites evaluated

Fig. 11. Aynabulak market buffer zone and street food vending sites evaluated

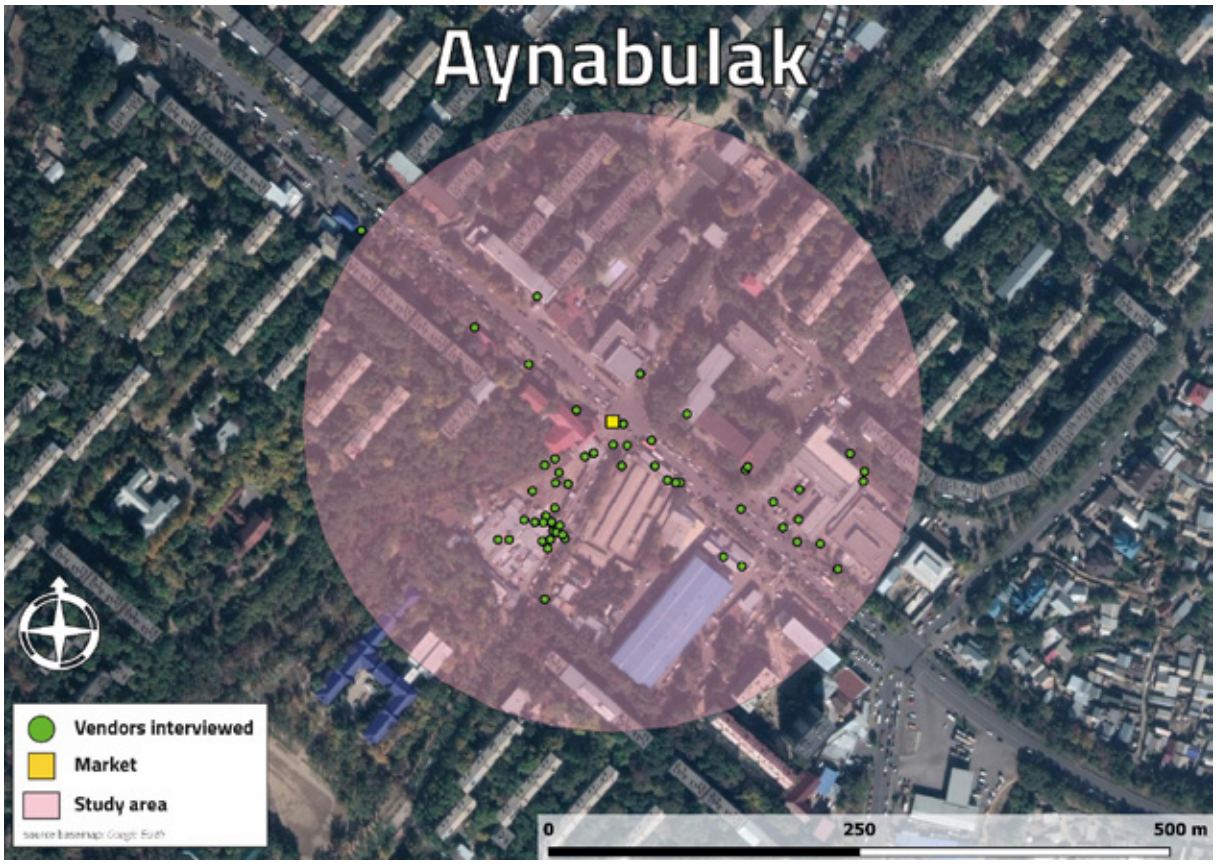


Fig. 12. Rynok Almaty 1 buffer zone and street food vending sites evaluated

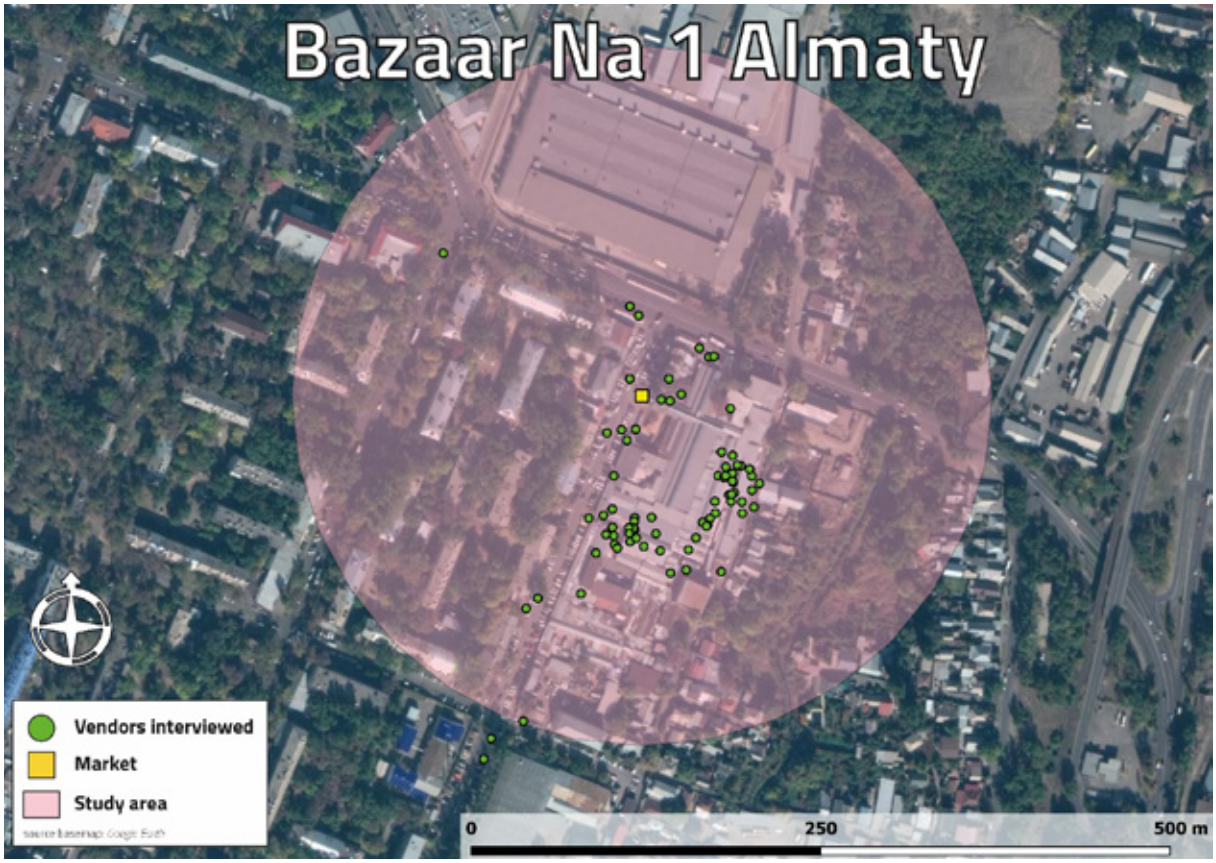


Fig. 13. Selected markets in Aktau

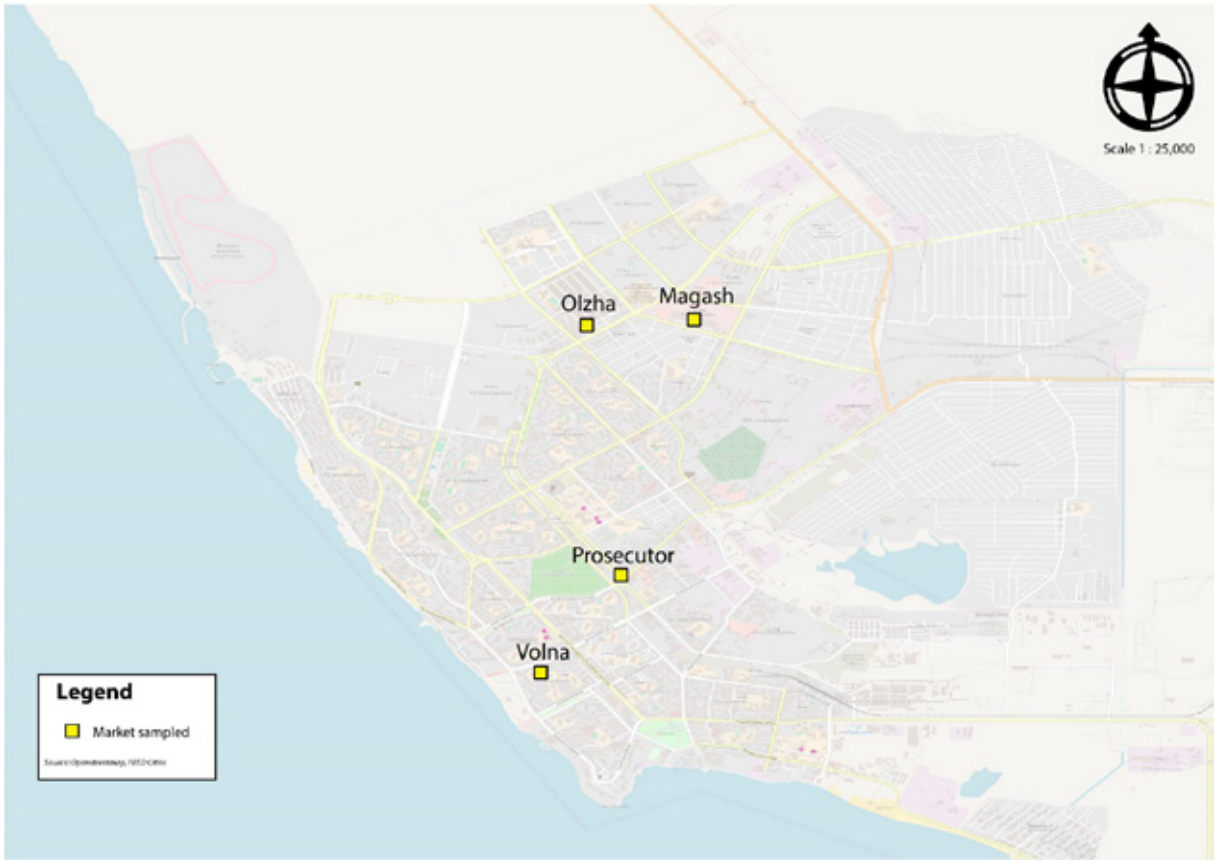
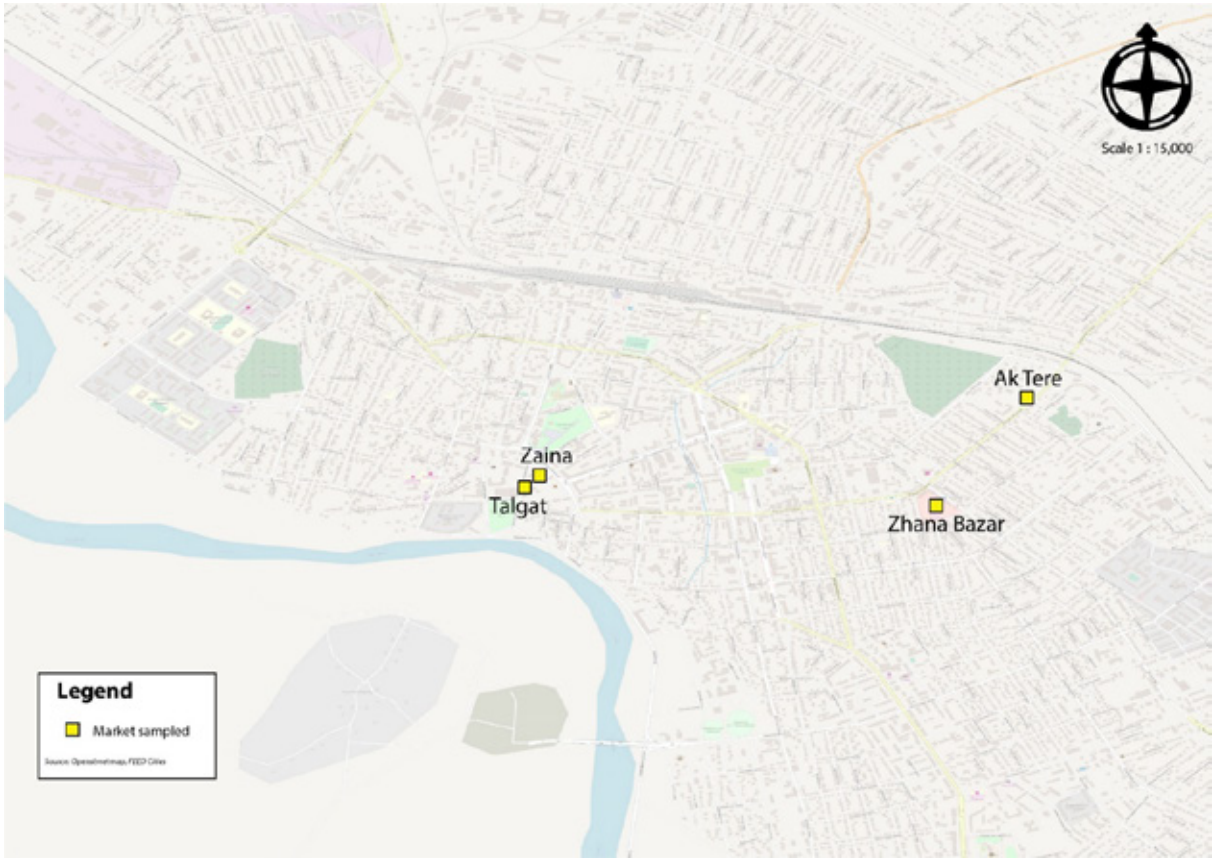


Fig. 14. Selected markets in Kyzylorda



Characteristics of vendors and vending sites

The characteristics of street food vendors in Almaty are listed in Table 7. Most were women (74.2%), operated a stationary vending site (92.7%) and were employers of the business (67.2%). Most of the street food vendors interviewed were from the Almalinsky district (37.8%).

Table 7. Characteristics of street food vendors in Almaty, overall and by district

Characteristic	All (n=384)	District					
		Almalinsky (n=145)	Auezovsky (n=41)	Bostandyksky (n=8)	Medeusky (n=82)	Turksibsky (n=81)	Zhetususky (n=27)
Sex (%)							
Women	74.2	66.9	82.9	62.5	81.7	76.5	74.1
Men	25.8	33.1	17.1	37.5	18.3	23.5	25.9
Type of vendor (%)							
Stationary	92.7	93.1	97.6	100.0	85.4	95.1	96.3
Mobile	7.3	6.9	2.4	0.0	14.6	4.9	3.7
Owner (%)							
Yes	32.8	39.3	26.8	12.5	31.7	30.9	22.2
No	67.2	60.7	73.2	87.5	68.3	69.1	77.8

Several types of stationary vending sites were observed (Table 8). Overall, the most prevalent physical setups were *dukoni* (59.6%) and a "stand, stall or booth" (29.2%). Although the physical setups were different in each of the six Almaty districts, these two were generally the most frequent.

Table 8. Types of the stationary vending site in Almaty, overall and by district

Type (%)	Total (n=356)	District					
		Almalinsky (n=135)	Auezovsky (n=40)	Bostandyksky (n=8)	Medeusky (n=70)	Turksibsky (n=77)	Zhetususky (n=26)
Dukoni	59.6	76.3	62.5	50.0	45.7	44.2	53.9
Stand/stall/booth	29.2	17.0	22.5	50.0	50.0	32.5	30.8
Truck	3.7	1.5	7.5	0.0	0.0	10.4	0.0
Freezer machine*	3.4	1.5	2.5	0.0	2.9	3.9	15.4
Bench with table	2.5	3.7	0.0	0.0	1.4	3.9	0.0
Push cart	1.4	0.0	5.0	0.0	0.0	3.9	0.0
Table and chairs	0.3	0.0	0.0	0.0	0.0	1.3	0.0

* Frequently sold ice cream, lemonade or other beverages

All the vendors had access to clean water, and most reported that they had access to a toilet (99.2%). When asked where they usually washed their hands during the day, 86.2% replied "toilet" and 12.9% "basin". Five vendors reported that they had no place to wash their hands. Nine of ten stationary vending sites reported access to electricity.

Most vendors reported that they sold food 6 days a week (94.7%) throughout the year (91.0%), regardless of the weather (90.1%).

Characteristics of street food offered in Almaty

Fruit was available in 1.0% (mobile: 0.0%, stationary: 1.1%) and beverages at 47.1% of vending sites (mobile: 57.1%, stationary: 46.6%). Food other than fruit was sold at 92.7% of the vending sites (mobile: 82.1%, stationary: 93.5%). The distribution of the different categories of street food in each district was similar to the overall distribution. Among the stationary vending sites selling food other than fruit, those selling only homemade foods were more frequent (54.4%) than vending sites selling exclusively industrial foods (36.6%) and both homemade and industrial foods (9.0%). Across districts, the offer of food other than fruit was similar to the overall figure, except in Almalinsky, in which vending sites selling only industrial foods were the most frequent (51.2%), and in Bostandyksky, where vending sites selling homemade and industrial foods were the second most frequent (25.0%) (Table 9).

Table 9. Food offered at all sites and at stationary vending sites, by district in Almaty

Food offered (%)	Total (n=384)	Stationary						
		Total (n=356)	District					
			Almalinsky (n=135)	Auezovsky (n=40)	Bostandyksky (n=8)	Medeusky (n=70)	Turksibsky (n=77)	Zhetususky (n=26)
Fruit	1.0	1.1	0.0	0.0	0.0	2.9	0.0	7.7
Food other than fruit	92.7	93.5	95.6	95.0	100.0	94.3	87.0	96.2
Industrial	-	36.6	51.2	26.3	12.5	22.7	31.3	36.0
Homemade	-	54.4	38.8	65.8	62.5	63.6	65.7	60.0
Homemade and industrial	-	9.0	10.1	7.9	25.0	13.6	3.0	4.0
Beverages	47.1	46.4	39.3	55.0	25.0	55.7	50.7	38.5

The most common homemade foods sold in the streets of Almaty were bread (30.4%), *samsa* (27.6%), prepared salad (18.2%) and *kurt* (18.2%). Table 10 lists the preparation, packaging and storage temperature of the foods. Bread (74.5%) and *samsa* (100%) were usually prepared the same day, while salad was usually prepared 1 day earlier (51.5%) and *kurt* more than 2 days earlier (90.9%). Bread and *samsa* were usually prepared at the vending site (40.0% and 94.0%), while salad and *kurt* were usually prepared at home (75.8% and 66.7%). Most stationary vending sites sold foods manufactured by employees (from 30.3% for *kurt* to 78.2% for bread) and unpackaged (54.5% for *kurt* and 80.0% for *samsa)*. Generally, foods were stored at room temperature (84.0% of *samsa* and 97.0% of *kurt*), except salad, which was usually stored in the cold (63.6%).

Table 10. Characteristics of a sub-sample of the homemade foods most commonly offered at stationary vending sites in Almaty

Characteristic	Bread (n=55)	*Samsa* (n=50)	Salad (n=33)	*Kurt* (n=33)
Date of preparation, n (%)				
Same day	41 (74.5)	50 (100.0)	16 (48.5)	3 (9.1)
1 day before	14 (25.5)	-	17 (51.5)	-
2 days before	-	-	-	-
> 2 days before	-	-	-	30 (90.9)
Place of preparation, n (%)				
At home	12 (21.8)	1 (2.0)	25 (75.8)	22 (66.7)
At the vending site	22 (40.0)	47 (94.0)	6 (18.2)	3 (9.1)
Both	1 (1.8)	-	-	-
Bought from another vendor	4 (7.3)	-	-	8 (24.2)
Restaurant or cafeteria	-	1 (2.0)	2 (6.0)	-
Bakery	16 (29.0)	1 (2.0)	-	-
Food handler (preparation), n (%)*				
Employees	43 (78.2)	37 (74.0)	14 (42.4)	10 (30.3)
Owner	6 (10.9)	12 (24.0)	12 (36.4)	9 (27.3)
Relatives	4 (7.3)	-	7 (21.2)	5 (15.2)
Does not know	-	-	-	9 (27.3)
Packaging, n (%)				
Industrially packaged	1 (1.8)	-	1 (3.0)	2 (6.1)
Manually packaged	15 (27.3)	10 (20.0)	13 (39.3)	13 (39.4)
No package	39 (70.9)	40 (80.0)	19 (57.6)	18 (54.5)
Storage temperature at time of selling, n (%)				
Cold	2 (3.6)	1 (2.0)	21 (63.6)	1 (3.0)
Warm	4 (7.3)	7 (14.0)	-	-
Room temperature	49 (89.1)	42 (84.0)	12 (36.4)	32 (97.0)

* Data missing because of misclassification during collection

Many kinds of beverages were available at both stationary and mobile vending sites in Almaty (Table 11). Those most commonly sold were water (57.5%), soft drinks (56.4%) and traditional beverages (52.8%). Generally, alcoholic beverages were not available in the street food environment in Almaty, except for *kumys* (9.4%) and *kvas* (6.6%), two traditional beverages with a low alcohol content (< 2.5%). Mobile street food vendors sold tea (100%), coffee (87.5%), traditional beverages (62.5%) and water (6.3%) (Table 11).

Overall, the offer of beverages was similar in the six districts. Traditional beverages were, however, the most frequently available drinks in Auezovsky (69.6%), Medeusky (66.0%) and Zhetususky (50.0%). Energy drinks were available in over half the vending sites in Turksibsky, and tea was available at almost 4 of 10 vending sites in Almalinsky.

Table 11. Beverages offered at street food vending sites in Almaty, by type of vendor and district

Type of beverage (%)	All (n=182)	Type of vending site		District					
		Stationary	Mobile	Almalinsky	Auezovsky	Bostandyksky	Medeusky	Turksibsky	Zhetususky
		(n=169)	(n=16)	(n=59)	(n=23)	(n=2)	(n=46)	(n=41)	(n=10)
Water	57.5	62.1	6.3	59.3	52.2	100.0	45.7	73.2	40.0
Soft drinks	56.4	61.5	0.0	55.9	52.2	100.0	52.2	65.9	40.0
Traditional beverages	52.8	51.8	62.5	50.9	69.6	100.0	66.0	29.3	50.0
Ayran	23.8	25.9	0.0	18.6	21.7	50.0	34.8	17.1	30.0
Kompot	13.3	9.6	50.0	18.6	0.0	50.0	21.7	2.4	10.0
Kumys	9.4	10.2	0.0	10.2	4.4	0.0	15.2	7.3	0.0
Shubat	9.4	10.2	0.0	10.2	4.4	0.0	15.2	7.3	0.0
Kvas	6.6	7.2	0.0	6.8	8.7	50.0	2.2	9.8	0.0
Kozhe	6.1	6.0	12.5	10.2	0.0	0.0	8.7	0.0	10.0
Kefir	5.5	6.0	0.0	1.7	13.0	50.0	8.7	2.4	0.0
Yoghurt	5.5	6.0	0.0	5.1	13.0	0.0	8.7	0.0	0.0
Energy drinks	30.4	33.1	0.0	25.4	26.1	0.0	19.6	53.7	30.0
Tea	30.2	23.5	100.0	39.0	17.4	50.0	29.8	26.8	20.0
Coffee	25.4	19.3	87.5	33.9	8.7	50.0	26.1	22.0	20.0
Fruit juice-based drink	21.6	23.5	0.0	20.3	26.1	50.0	21.7	19.5	20.0
Milk	11.1	12.1	0.0	6.8	17.4	50.0	19.6	4.9	0.0
Fruit or milk cocktail or slush	7.1	7.8	0.0	3.4	39.1	0.0	2.1	2.4	0.0
Fresh fruit juice	2.8	3.0	0.0	3.4	0.0	0.0	6.5	0.0	0.0

Nutritional composition of street foods

The nutritional composition of the 30 most commonly available foods other than fruit, collected in the streets of Almaty, Aktau and Kyzylorda are shown in Tables 12–14. The TFA, sodium and potassium contents varied substantially among the products analysed and varied slightly by region.

In Almaty (Table 12), the mean TFA content per serving was highest in homemade *pirozhnoe* (3.20 g), homemade *samsa* (2.14 g), industrial wafers (1.98 g) and homemade *shashlik* (1.87 g), corresponding to 144.3%, 96.4%, 89.2% and 84.5% of the recommended maximum TFA daily intake, respectively. The mean TFA content per serving was lowest in homemade pancakes (0.10 g) cabbage salad (0.07 g), industrial croutons (0.03 g) and homemade *kozhe* (0.01 g), corresponding to 4.5%, 3.2%, 1.6% and 0.6% of the recommended daily maximum, respectively.

The highest mean sodium contents per serving were found in homemade *lagman* (2248 mg), *plov* (2084 mg), *doner kebab* (1707 mg) and *kurt* (1084 mg), corresponding to 112.4%, 104.2%, 85.4% and 54.2% of the recommended maximum daily intake, respectively. The lowest mean sodium contents per serving were found in sweet snacks and pastries, such as

industrial *pirozhnoe* (90 mg), popcorn (73 mg), *pryaniki* (57 mg) and homemade *jent* (11 mg), corresponding to 4.5%, 3.7%, 2.8% and 0.6% of the recommended maximum, respectively.

The mean potassium content per serving was highest in homemade *doner kebab* (1327 mg), *lagman* (964 mg), *plov* (571 mg) and corn (500 mg), corresponding to 37.8%, 27.5.0%, 21.6% and 14.3% of the recommended minimum daily intake. The mean potassium content per serving was lowest in homemade *baursak* (75 mg) *kozhe* (69 mg), industrial *keksi* (62 mg) and biscuits (44 mg), corresponding to 2.1%, 2.0%, 1.8% and 1.2% of the recommended daily minimum.

In Aktau (Table 13), the mean TFA content per serving was highest in industrial wafers (1.77 g) and biscuits (0.94 g), corresponding to 79.9% and 42.7% of the recommended maximum daily intake, respectively. The mean TFA content per serving was lowest in *kurt* (0.02 g) and *lepyoshka* bread (0.01 g), corresponding to 1.2% and 0.3% of the recommended maximum daily intake, respectively. In Kyzylorda, the mean TFA content per serving was also highest in industrial wafers (5.05 g) and homemade *doner kebab* (0.75 g), corresponding, respectively, to 227.1% and 34.0% of the recommended maximum daily intake. The mean TFA content per serving was lowest in industrial biscuits (0.04 g) and homemade *lepyoshka* bread (0.00 g), corresponding to 2.1% and 0.2% of the recommended maximum, respectively.

The highest mean sodium content in foods collected in Aktau were in *doner kebab* (1425 mg) and *kurt* (791 mg), corresponding to 71.2% and 39.6% of the recommended maximum daily intake. The lowest sodium contents were found in wafers (77 mg) and chocolate (18 mg), corresponding to 3.9% and 0.9% of the recommended maximum, respectively. In Kyzylorda, the highest mean sodium contents per serving were found in homemade cabbage salad (2090 mg) and in *doner kebab* (1532 mg), corresponding to 104.5% and 76.6% of the recommended maximum. The lowest sodium contents were found in industrial biscuits (155 mg) and wafers (108 mg), corresponding to 7.7% and 5.4% of the recommended maximum daily intake.

The mean potassium contents per serving in Aktau were highest in homemade *doner kebab* (954 mg) and industrial crisps (780 mg), corresponding to 27.2% and 22.2% of the recommended minimum daily intake. The mean potassium content per serving was lowest in homemade *baursak* (50 mg) and biscuits (47 mg), corresponding to 1.4% and 1.3% of the recommended minimum intake. In Kyzylorda, homemade *doner kebab* (891 mg) and cabbage salad (490 mg) had the highest potassium contents, corresponding to 25.4% and 13.9% of the recommended minimum daily intake. The lowest potassium content was found in industrial croutons (72 mg) and biscuits (62 mg), corresponding to 2.1% and 1.8% of the recommended minimum daily intake.

Overall, for the food samples collected in all the three cities (Table 14), the mean TFA content per serving was highest in homemade *pirozhnoe* (3.20 g), industrial wafers (2.69 g), homemade *shashlik* (1.87 g) and industrial *keksi* (1.37 g), corresponding to 144.3%, 121.3%, 84.5% and 61.7% of the recommended maximum daily intake, respectively. The mean TFA content per serving was lowest in homemade cabbage salad (0.09 g), industrial dry bread rings (0.06 g), industrial popcorn (0.04 g) and homemade *kozhe* (0.01 g), corresponding to 4.0%, 3.0%, 1.7% and 0.6% of the recommended maximum, respectively.

The highest mean sodium contents per serving were observed in homemade *lagman* (2248 mg), *plov* (2085 mg), *doner kebab* (1593 mg) and *kurt* (1083 mg), corresponding to 112.4%, 104.2%, 79.6% and 54.2% of the recommended maximum, respectively. The lowest mean sodium contents per serving were observed in industrial popcorn (73 mg), homemade ice-cream (69 mg), industrial *pryaniki* (57 mg) and homemade *jent* (11 mg), corresponding to 3.7%, 3.4%, 2.8% and 0.6% of the recommended maximum daily intake, respectively.

The mean potassium content per serving was highest in homemade *doner kebab* (1125 mg), *lagman* (964 mg), *plov* (758 mg) and corn (500 mg), corresponding to 32.1%, 27.5%, 21.6% and 14.3% of the recommended minimum daily intake. The mean content per serving was lowest in homemade *jent* (70 mg) *kozhe* (69 mg), industrial *keksi* (62 mg) and biscuits (49 mg), corresponding to 2.0%, 2.0%, 1.8% and 1.4% of the daily recommended minimum intake.

These results show that a large proportion of both homemade and industrial street foods available in Kazakhstan are nutritionally inadequate. The findings were similar for the three cities.

The TFA content varied between homemade and industrial products. Whereas in Almaty the highest TFA content was found mainly in homemade foods, in the other cities industrial foods had higher TFA levels. Overall, industrial wafers contained the most TFA content, a single portion containing 46.4–158.6% of the maximum recommended daily intake. Biscuits had the lowest TFA content in Almaty and Kyzylorda but one of highest contents in Aktau. These results indicate that both homemade and industrial foods in the country have high TFA levels and therefore that a common national strategy should be implemented.

One concern with regard to the sodium content of street food in Kazakhstan is that most of the foods with the highest contents were traditional dishes (e.g. *plov*, *lagman*, cabbage salad, *doner kebab*) and snacks (e.g. *kurt)*, which are extremely popular throughout the country. One portion of most of these foods accounted for almost all the 2000 mg recommended by WHO as the maximum daily intake. Therefore, less salt should be added during cooking and preparation. The high sodium content of traditional foods has been attributed to the "Silk Road" pattern, in which the use of salt for food preservation remains strong in the food culture *(31)*. A comparison of foods such as *doner kebab*, *lagman*, *plov* and cabbage salad bought in the three cities, however, showed wide differences in sodium content. Therefore, culinary practices could be adjusted without undermining local gastronomy.

Generally, the street foods analysed had potassium contents below the minimum recommended. Most homemade traditional dishes made of vegetables and/or potatoes, such as *lagman*, *plov* and *doner kebab*, had reasonable levels of potassium, although they were rich in sodium. The industrial street foods analysed generally had the lowest potassium content.

Table 12. Nutritional composition of food samples in Almaty

Food	N	Mean serving size (g)	*trans*-Fatty acids			Sodium			Potassium		
			Mean (min-max) g/ serving		% of recommended*	Mean (min-max) g/ serving		% of recommended*	Mean (min-max) g/ serving		% of recommended*
Industrial foods											
Biscuits	4	38	0.24	(0.04 -0.44)	11.0	98	(1 -138)	4.9	44	(30 -55)	1.2
Crisps	4	40	0.16	(0.08 -0.22)	7.1	239	(82 -348)	11.9	194	(86 -243)	5.5
Chocolate	4	94	0.17	(0.07 -0.29)	8.0	99	(45 -213)	4.9	415	(239 -671)	11.8
Croutons	4	36	0.03	(0.01 -0.07)	1.6	262	(109 -453)	13.1	111	(59 -143)	3.2
Dry bread rings	4	31	0.29	(0.18 -0.47)	13.2	119	(72 -178)	6.0	62	(58 -67)	1.8
Keksi (muffin)	4	76	1.37	(0.01 -3.99)	61.7	138	(38 -252)	6.9	144	(59 -237)	4.1
Pirozhnoe (cake)	4	77	1.36	(0.33 -2.37)	61.3	90	(27 -129)	4.5	101	(78 -145)	2.9
Popcorn	4	63	0.37	(0.00 -0.13)	1.7	73	(0 -122)	3.7	111	(89 -138)	3.2
Pryaniki (gingerbread)	4	50	0.36	(0.02 -0.71)	16.3	57	(7 -111)	2.8	87	(37 -144)	2.5
Wafers	4	54	1.98	(1.03 -3.52)	89.2	111	(63 -153)	5.5	134	(60 -165)	3.8
Homemade foods											
Belyashi	4	119	0.24	(0.01 -0.57)	11.0	458	(363 -539)	22.9	163	(143 -195)	4.6
Bread (*lepyoshka*)	4	60	0.20	(0.00 -0.73)	9.2	261	(227 -322)	13.1	94	(61 -109)	2.1
Baursak	4	63	0.18	(0.12 -0.28)	8.5	292	(192 -395)	14.6	75	(49 -96)	2.1
Bun	4	96	0.47	(0.00 -1.51)	21.3	165	(28 -453)	8.2	120	(38 -182)	3.4
Chebureki	4	124	0.36	(0.15 -0.57)	16.3	642	(447 -850)	32.1	181	(147 -211)	5.2
Corn cob	4	220	0.22	(0.00 -0.84)	9.9	158	(3 -429)	7.9	500	(320 -841)	14.3
Doner kebab	4	385	0.45	(0.18 -0.72)	20.3	1707	(1357 -1983)	85.4	1327	(1179 -1561)	37.8
Ice cream	4	132	0.12	(0.03 -0.18)	5.5	69	(39 -121)	3.4	218	(119 -308)	6.2
Jent	4	60	1.11	(0.35 -1.40)	50.3	11	(5 -15)	0.6	70	(40 -100)	2.0
Kozhe	4	200	0.01	(0.00 -0.03)	0.6	657	(591 -757)	32.9	69	(43 -104)	2.0
Kurt	4	31	0.30	(0.04 -0.81)	13.7	1084	(818 -1278)	54.2	78	(58 -106)	2.2

Food	N	Mean serving size (g)	*trans*-Fatty acids				Sodium				Potassium			
			Mean (min-max) g/ serving			% of recommended*	Mean (min-max) g/ serving			% of recommended*	Mean (min-max) g/ serving			% of recommended*
Lagman	4	524	0.35	(0.08	-0.56)	15.9	2248	(1577	-3735)	112.4	964	(369	-1976)	27.5
Pancakes	4	107	0.10	(0.03	-0.21)	4.5	340	(214	-444)	17.0	144	(72	-196)	4.1
Pirozhki	4	123	0.19	(0.12	-0.28)	8.7	437	(390	-498)	21.9	185	(152	-222)	5.3
Pirozhnoe (cake)	5	118	3.20	(0.06	-9.18)	144.3	260	(51	-551)	13.0	141	(35	-355)	4.0
Plov	4	406	0.59	(0.42	-0.72)	26.6	2084	(1465	-2692)	104.2	758	(460	-989)	21.6
Salad (cabbage)	4	90	0.07	(0.03	-0.15)	3.2	601	(436	-740)	30.1	156	(144	-171)	4.4
Samsa	4	96	2.14	(0.04	-4.80)	96.4	475	(338	-842)	23.8	144	(81	-179)	4.1
Sausage roll	4	99	0.16	(0.01	-0.38)	7.3	633	(421	-734)	31.6	120	(84	-149)	3.4
Shashlik	4	96	1.87	(1.03	-2.61)	84.5	644	(242	-837)	32.2	343	(211	-499)	9.8

* Percentages of WHO recommended levels were computed for an average adult with an intake of 2000 kcal. WHO recommendations: TFA: < 1% total energy value/day *(11)*; sodium: < 2000 mg/day *(15)*; potassium: ≥ 3510 mg/day *(18)*.

Table 13. Nutritional composition of the food samples from Aktau and Kyzylorda

			trans-Fatty acids				Sodium				Potassium			
	N	Mean serving size (g)	Mean (min-max) g/ serving			% of recommended*	Mean (min-max) g/ serving			% of recommended*	Mean (min-max) g/ serving			% of recommended*
Aktau														
Industrial foods														
Crisps	2	45	0.13	(0.11	-0.14)	5.9	272	(261	-283)	13.6	780	(707	-853)	22.2
Chocolate	2	30	0.04	(0.03	-0.04)	1.8	18	(16	-20)	0.9	116	(104	-128)	3.3
Biscuits	2	32	0.94	(0.22	-1.66)	42.7	80	(58	-103)	4.0	47	(20	-74)	1.3
Croutons	2	34	0.05	(0.00	-0.09)	2.1	221	(162	-280)	11.1	66	(36	-96)	1.9
Wafers	2	41	1.77	(1.74	-1.80)	79.9	77	(52	-103)	3.9	52	(23	-81)	1.5
Homemade foods														
Belyashi	2	121	0.39	(0.35	-0.43)	17.6	657	(628	-686)	32.8	149	(143	-156)	4.3
Bread (*Lepyoshka*)	2	61	0.01	(0.00	-0.01)	0.3	397	(321	-472)	19.8	133	(104	-161)	3.8
Baursak	2	45	0.58	(0.35	-0.81)	26.4	116	(78	-154)	5.8	50	(36	-63)	1.4
Bun	2	61	0.03	(0.01	-0.05)	1.4	183	(165	-200)	9.1	97	(74	-120)	2.8
Doner kebab	2	324	0.36	(0.25	-0.47)	16.4	1425	(1373	-1477)	71.2	954	(644	-1265)	27.2
Kurt	2	22	0.02	(0.01	-0.03)	1.2	791	(689	-893)	39.6	54	(36	-71)	1.5
Pirozhki	2	107	0.19	(0.15	-0.22)	8.6	425	(424	-427)	21.3	288	(241	-335)	8.2
Salad (cabbage)	2	108	0.09	(0.05	-0.13)	4.4	700	(329	-1071)	35.0	247	(231	-262)	7.0
Samsa	2	127	0.56	(0.19	-0.92)	25.3	631	(450	-813)	31.6	214	(199	-228)	6.1
Sausage roll	2	84	0.17	(0.12	-0.22)	7.7	432	(377	-487)	21.6	97	(93	-100)	2.8

			trans-Fatty acids				Sodium				Potassium			
	N	Mean serving size (g)	Mean (min-max) g/ serving			% of recommended*	Mean (min-max) g/ serving			% of recommended*	Mean (min-max) g/ serving			% of recommended*
Kyzylorda														
Industrial foods														
Crisps	2	40	0.16	(0.13	-0.19)	7.5	372	(227	-518)	18.6	131	(121	-141)	3.7
Chocolate	2	98	0.13	(0.11	-0.15)	5.9	162	(81	-243)	8.1	349	(208	-490)	9.9
Biscuits	2	46	0.04	(0.02	-0.06)	2.1	155	(97	-213)	7.7	62	(38	-86)	1.8
Croutons	2	37	0.15	(0.00	-0.29)	6.6	210	(172	-247)	10.5	72	(69	-76)	2.1
Wafers	2	61	5.05	(2.27	-7.82)	227.1	108	(93	-123)	5.4	86	(71	-100)	2.4
Homemade foods														
Belyashi	2	114	0.30	(0.18	-0.41)	13.6	391	(374	-408)	19.5	135	(111	-160)	3.9
Bread (*Lepyoshka*)	2	63	0.00	(0.00	-0.01)	0.2	273	(186	-359)	13.6	91	(89	-93)	2.6
Baursak	2	75	0.12	(0.11	-0.13)	5.8	362	(205	-519)	18.1	119	(111	-127)	3.4
Bun	2	107	0.17	(0.11	-0.23)	7.8	212	(179	-246)	10.6	135	(132	-139)	3.9
Doner kebab	2	272	0.75	(0.42	-1.08)	34.0	1532	(1072	-1993)	76.6	891	(804	-979)	25.4
Kurt	2	45	0.03	(0.01	-0.04)	1.5	1374	(1366	-1381)	68.7	123	(94	-153)	3.5
Pirozhki	2	87	0.17	(0.09	-0.24)	7.6	315	(248	-383)	15.8	150	(148	-153)	4.3
Salad (cabbage)	2	274	0.12	(0.03	-0.20)	5.3	2090	(1402	-2777)	104.5	490	(402	-577)	13.9
Samsa	2	111	0.40	(0.38	-0.41)	17.8	716	(568	-863)	35.8	198	(133	-264)	5.6
Sausage roll	2	94	0.16	(0.09	-0.22)	7.3	518	(499	-537)	25.9	162	(157	-167)	4.6

*Percentages of WHO recommendations computed for an average adult with an intake of 2000 kcal. WHO recommendations: TFA: < 1% total energy value/day *(11)*[3]; sodium: < 2000 mg/day *(15)*[4]; potassium: ≥ 3510 mg/day *(18)*[5]

Table 14. Nutritional composition of the food samples from Almaty, Aktau and Kyzylorda

			trans-Fatty acids				Sodium				Potassium			
	N	Mean serving size (g)	Mean (min-max) g/ serving			% of recommended*	Mean (min-max) g/ serving			% of recommended*	Mean (min-max) g/ serving			% of recommended*
Industrial foods														
Crisps [a]	8	41	0.15	(0.08	-0.22)	6.9	281	(82	-518)	14.0	325	(86	-853)	9.3
Chocolate [a]	8	79	0.13	(0.03	-0.29)	5.9	95	(16	-243)	4.7	324	(104	-671)	9.2
Biscuits [a]	8	38	0.37	(0.02	-1.66)	16.7	108	(1	-213)	5.4	49	(20	-86)	1.4
Croutons [a]	8	35	0.06	(0.00	-0.29)	3.0	239	(109	-453)	11.9	90	(36	-143)	2.6
Dry bread rings [b]	4	33	0.29	(0.18	-0.47)	13.2	119	(72	-178)	6.0	62	(58	-67)	1.8
Keksi [b]	4	76	1.37	(0.01	-3.99)	61.7	138	(38	-252)	6.9	144	(59	-237)	4.1
Pirozhnoe [b]	4	77	1.36	(0.33	-2.37)	61.3	90	(27	-129)	4.5	101	(78	-145)	2.9
Popcorn [b]	4	63	0.04	(0.00	-0.13)	1.7	73	(0	-122)	3.7	111	(89	-138)	3.2
Pryaniki [b]	4	50	0.36	(0.02	-0.71)	16.3	57	(7	-111)	2.8	87	(37	-144)	2.5
Wafers [a]	8	53	2.69	(1.03	-7.82)	121.3	102	(52	-153)	5.1	101	(23	-165)	2.9
Homemade foods														
Belyashi [a]	8	119	0.29	(0.01	-0.57)	13.3	491	(363	-686)	24.6	153	(111	-195)	4.3
Baursak [a]	8	62	0.27	(0.11	-0.81)	12.3	265	(78	-519)	13.3	80	(36	-127)	2.3
Bread (*Lepyoshka*) [a]	8	61	0.10	(0.00	-0.73)	4.7	298	(186	-472)	14.9	103	(61	-161)	2.9
Bun [a]	8	90	0.28	(0.00	-1.51)	12.9	181	(28	-453)	9.1	118	(38	-182)	3.4
Chebureki [b]	4	124	0.36	(0.15	-0.57)	16.3	642	(447	-850)	32.1	181	(147	-211)	5.2
Corn cob [b]	4	220	0.22	(0.00	-0.84)	9.9	158	(3	-429)	7.9	500	(320	-841)	14.3
Doner Kebab	8	342	0.50	(0.18	-1.08)	22.7	1593	(1072	-1933)	79.6	1125	(644	-1561)	32.1
Ice-cream [b]	4	132	0.12	(0.03	-0.18)	5.5	69	(39	-121)	3.4	218	(119	-308)	6.2
Jent [b]	4	60	1.11	(0.35	-1.40)	50.3	11	(5	-15)	0.6	70	(40	-100)	2.0
Kozhe [b]	4	200	0.01	(0.00	-0.03)	0.6	657	(591	-757)	32.9	69	(43	-104)	2.0
Kurt [a]	8	32	0.16	(0.01	-0.81)	7.5	1083	(689	-1381)	54.2	83	(36	-153)	2.4

	N	Mean serving size (g)	*trans*-Fatty acids				Sodium				Potassium			
			Mean (min-max) g/ serving			% of recommended*	Mean (min-max) g/ serving			% of recommended*	Mean (min-max) g/ serving			% of recommended*
Lagman [b]	4	524	0.35	(0.08	-0.56)	15.9	2248	(1577	-3735)	112.4	964	(369	-1976)	27.5
Pancakes [b]	4	107	0.10	(0.03	-0.21)	4.5	340	(214	-444)	17.0	144	(72	-196)	4.1
Pirozhki [a]	8	110	0.18	(0.09	-0.28)	8.4	404	(248	-498)	20.2	202	(148	-335)	5.8
Pirozhnoe [b]	5	118	3.20	(0.06	-9.18)	144.3	260	(51	-551)	13.0	141	(35	-355)	4.0
Plov [b]	4	406	0.59	(0.42	-0.72)	26.6	2085	(1465	-2692)	104.2	758	(460	-989)	21.6
Salad (cabbage) [a]	8	141	0.09	(0.03	-0.20)	4.0	998	(329	-2777)	49.9	262	(144	-577)	7.5
Samsa [a]	8	107	1.31	(0.04	-4.80)	59.0	574	(338	-863)	28.7	175	(81	-264)	5.0
Sausage roll [a]	8	94	0.16	(0.01	-0.38)	7.4	554	(377	-734)	27.7	125	(84	-167)	3.6
Shashlik [b]	4	96	1.87	(1.03	-2.61)	84.5	644	(242	-837)	32.2	343	(211	-499)	9.8

* Percentages of WHO recommended levels were computed for an average adult with an intake of 2000 kcal. WHO recommendations: TFA: < 1% total energy value/day *(11)*[3]; sodium: < 2000 mg/day *(15)*[4]; potassium: ≥ 3510 mg/day *(18)*[5]

[a] Food collected in Almaty, Aktau and Kyzylorda; [b] food collected in Almaty.


БАЛАБАНОВСКИЕ

4. Conclusions and policy implications

The study reported here was conducted with a standard method to provide an overview of the street food context in Almaty and of the nutritional composition of street foods in Aktau and Kyzylorda. In Almaty, the street food offer is abundant, and it is available in all the markets assessed throughout the city. Of the 384 eligible vendors interviewed, most were women, worked in stationary vending sites and were employees. Basic sanitary conditions were accessible for most stationary vendors.

Fruit was sold by 1.0% of the eligible street food vending sites, food other than fruit by 92.7% and beverages by 47.1%. Although the availability of fruit is under-represented, as sites selling only unprepared fresh fruit were not included, the availability of nutritionally dense foods rich in fibre and sources of potassium such as fruit and vegetables should be increased for the urban population of Almaty in markets and other sources of street food.

Many types of beverages were sold; water, soft drinks and traditional beverages were available at over 50% of all vending sites selling beverages. This suggests that traditional food habits persist with more western options. Energy drinks were commonly available; this, and the high frequency of soft drinks, is a concern, given their high sugar content, which is known to be the main source of added sugar in the diet *(32)*. This probably contributes to excess energy intake and weight gain. WHO recommends a reduced intake of free sugars throughout the life-course *(32)*.

In Almaty, more homemade foods than industrial foods were available. The 30 foods most commonly found in Almaty (including the 15 street foods collected in Aktau and Kyzylorda) were traditional dishes and snacks, cakes, pastries and a traditional drink, *kozhe*. With regard to the nutritional composition of these common street foods, the highest levels of TFA were found mainly among homemade sweet and savoury snacks (e.g. *pirozhnoe*, *samsa*) and sandwiches (e.g. *doner kebab*) and also in industrial foods such as wafers. In some of these foods, the TFA content reached or surpassed the recommended daily maximum. This is a concern, as most of these foods are eaten throughout the day, possibly resulting in excessive intake of a nutrient that is clearly harmful to health. Although the overall potassium content of the street foods analysed in Kazakhstan is low, some homemade traditional dishes rich in vegetables and/or potato, such as *doner kebab*, *lagman* and cabbage salad, had the highest contents of this nutrient, representing 21.6–37.8% of the recommended daily minimum. Notably, homemade dishes that are apparently some of the healthier of the foods collected (e.g. *plov*, *lagman*, cabbage salad, *doner kebab, kurt)* were also the richest sources of sodium per serving. For some foods, a single portion attained or surpassed the recommended maximum daily intake of 2000 mg. The high TFA and sodium levels in many traditional foods indicates that there is room for improvement in culinary practices. The TFA and sodium content of most of the popular homemade foods collected in the three cities, however, varied widely, indicating that nutrition composition could be improved without interfering with traditional gastronomy. Awareness should be raised among food vendors and consumers, for example, that adding less salt and using healthier fats and ingredients would improve health at national level.

The results of this report show that the promotion of healthy diets is a national priority, salt and TFA being strategic starting points. Practical policies can be used to make the street food environment healthier, and they should be incorporated into existing policies, such as that for NCD prevention, which includes changing behaviour to adopt healthy diets and lifestyles and prevent obesity and other diet-related NCDs.

Reducing the salt and TFA content of ready-to-eat foods sold at street vending sites will probably require a multi-pronged approach, as seen in other programmes *(7)*. It could include educating street food vendors to use less salt and healthier fats and raising awareness among consumers that these foods may be harmful if consumed in excess. The most important component of changing the food context in Kazakhstan will be the leadership and regulatory role of the Government. The Government could adopt salt reduction targets for industrially produced foods (e.g. savoury snacks, bread, drinks), perhaps by regulating maximum limits, as has been done in many countries, including Finland, Greece and Turkey, but perhaps most comprehensively in Argentina and South Africa *(33)*. The limit would apply to all foods available on the market, including in supermarkets, to ensure equity. Such legislation would be consistent with and complementary to other legislation for food

security and nutrition and would not undermine initiatives such as salt iodization, which has been successfully implemented in the country.

WHO has prepared guidance for the elimination of industrially produced TFA from the global food supply at national level, the "REPLACE trans-fat free by 2023" action package *(12)*. The package consists of six activities: review dietary sources of industrially produced TFA; promote replacement with healthier fats and oils; legislate or enact regulations to eliminate industrially produced TFA; assess and monitor the TFA content of the food supply and changes in TFA consumption by the population; create awareness among policy-makers, producers, suppliers and the public of the negative effects of TFA on health; and enforce compliance with policies and regulations.

As a member of the Eurasian Economic Union, Kazakhstan has already adopted a technical regulation on fats and oils in food products that prohibits a TFA content > 2 g/100 g of fat by 2018. This regulation was introduced to commit members to limit the availability and use of TFA in food products. This study demonstrates, however, that additional measures must be taken, as most of the analysed foods are not yet compliant. Monitoring should be continued after the 2018 deadline in order to determine the TFA content of foods and the evolution towards their replacement with healthier options. A good example of monitoring to ensure compliance with legislation is that of Denmark, which introduced a ban on TFA in food in 2003 *(34)*.

In order to enhance compliance with legislation, the Government might consider additional measures to encourage processors, manufacturers and vendors to change to healthier oils. The measures would comply with one objective of the national NCD prevention programme which is to increase health literacy *(7)*. As street vendors and small-scale manufacturers are extremely price conscious, given the small profits they make, their choice of cooking fat 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 seen in other contexts *(35)*. For example, the "Healthier Hawker Programme" in Singapore improved the availability and access to healthier oils by bulk purchasing and improving the logistics and supply to street vendors. This reduced the price and encouraged vendors to change to healthier vegetable oils *(35)*. Dialogue with fats and oils producers could ensure compliance with the legislation *(36)*. A final aspect is improving the nutritional information on packaged foods in Kazakhstan, to ensure that all products bear a nutrient declaration (including for sodium) in addition to an ingredients list.

Such policies require Government leadership and also regular monitoring. For both salt reduction and TFA elimination, local food suppliers (e.g. manufacturers of oils and fats used in freshly prepared products, wholesale producers, manufacturers of breads, pastries and confectionary, savoury snacks, drinks, and processed meats) should be engaged to monitor their compliance with regulations and guidance. Such mapping has been conducted in India, for example, in a study of the barriers and opportunities to reduce the use of TFA in order to comply with Government policy *(37)*. Contact with international food suppliers will also be important, and the nutritional composition of foods within the Eurasian Economic Union should be discussed by members. Together, these activities would contribute significantly to the promotion of healthy diets and the prevention of obesity in Kazakhstan. The national programme on NCD prevention and control represents an excellent entry point for such policies, to involve all agencies implementing similar strategies.

This study shows that there is considerable room for improvement in the nutritional adequacy of street foods sold in Kazakhstan. It reinforces the need for related health policies to prevent the occurrence of diet-related NCDs in the country, while protecting the cultural and community role of street food. Regulation of production and promotion of the population's access to safe, affordable, nutritious street food is imperative to address NCDs and associated health disparities in the urban context.

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Annex 1. Examples of industrial foods collected at street food vending sites in Almaty

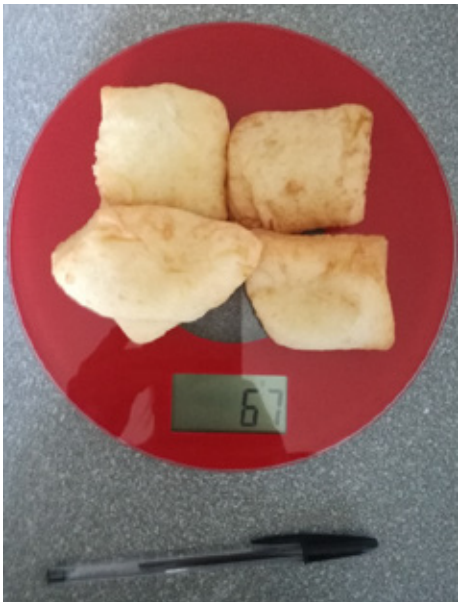
Crisps	
Chocolate	
Biscuits	

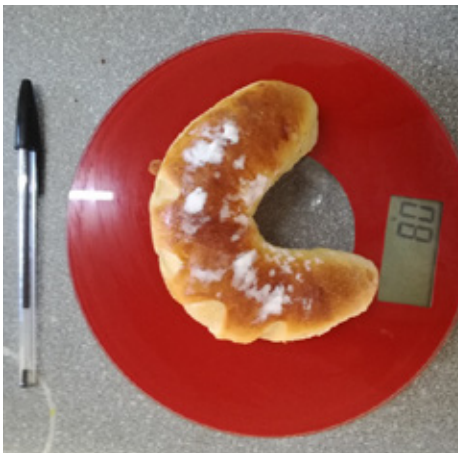
Croutons	
Dry bread rings	
Keksi (muffin)	

Pirozhnoe	
Popcorn	

Pryaniki	
Wafers	

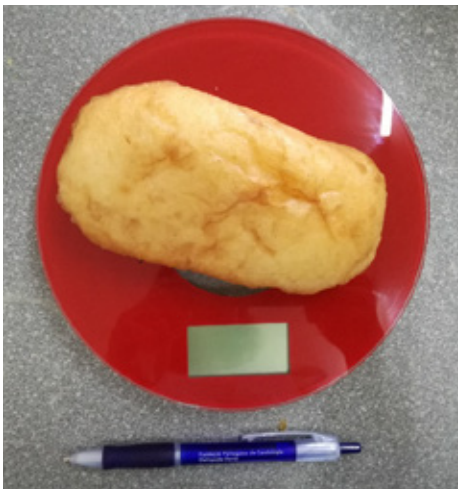
Annex 2. Examples of homemade foods collected at street food vending sites in Almaty

Belyashi	
Baursak	
Lepyoshka	

Bun	
Chebureki	
Corn cob	

Doner kebab	
Ice cream	
Jent	

Kozhe	
Kurt (Kurut)	
Lagman	

Pancake	
Pirozhki	
Pirozhnoe	
Plov	

Salad (cabbage)	
Samsa (sambusa, samosa)	
Sausage roll	
Shashlik	

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