

Food Store Choice Among Urban Slum Women Is Associated With Consumption of Energy-Dense Food

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Abstract

The aim of this study was to examine the associations of food store choice with food consumption among urban slum women. A cross-sectional survey was carried out among 188 urban slum women (19-50 years old) in Jakarta, Indonesia. A semiquantitative food frequency questionnaire was used to assess food consumption. Associations between food consumption and food store choice were tested by linear regression. This study found that frequencies of buying food from small shops (*warung*), street food vendors, and modern food stores were significantly associated with consumption of snacks, mixed dishes, and fruit respectively. In addition, buying food from traditional markets and small cafes (*warung makan*) was not significantly associated with particular types of food consumption. As modern food stores are rarely utilized by these women, small shops (*warung*) and street food vendors are likely to be important channels to improve slum dwellers' diet.

Keywords

food consumption, food environment, food store, Indonesia, urban slum

Introduction

There is growing evidence that changes within food environments are among the root causes of the obesity epidemic.^{1,2} The increasing *obesogenicity* of the environment, seen in the high availability of energy-dense nutrient-poor (EDNP) foods, is likely to be a major driver of increasing obesity prevalence in the general population.^{3,4}

The influence of food environments on obesity that was observed among the general population may be particularly important for poor populations in urban settings. The urban poor may be

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exposed to greater financial stress and, thus, find EDNP foods to be more affordable and accessible compared with healthy foods,^{5,6} making them prone to poorer diets than more affluent populations.^{7,8}

Examination of food store accessibility has been part of several food environment and diet studies. Living closer to supermarkets/farmer markets/traditional markets was associated with lower body mass index (BMI). In contrast, living closer to fast food outlets was associated with higher BMI.^{9,10} Living in neighborhoods with a higher proportion of stores selling healthy food was inversely associated with Western diets, whereas living in areas with a higher proportion of fast food outlets was inversely associated with prudent diets.¹¹ Such associations were predicted because supermarkets/farmer markets/traditional markets are known to have a greater availability of healthy foods at lower prices, whereas fast food outlets are known to offer mostly inexpensive, energy-dense foods.⁹ Taken together, accessibility to various types of food stores in neighborhoods is associated with food consumption of residents and determines obesity.

Previous studies on the influence of food environments on food consumption and body weight status have used geographical location methods (eg, proximity of food stores, number of food stores in buffers).^{9,11-14} However, a study examining accessibility by number of food stores in buffers¹³ and studies measuring distance and time spent travelling to food stores^{12,14} failed to show that living closer to fast food outlets was positively associated with higher BMI and lower healthy food intake. This is probably because geographical location does not indicate the actual purchasing behavior at nearby food stores.^{10,12-14} Assessment of the frequency of shopping in food stores is more reliable. For example, Gustafson et al¹⁵ reported that food store choice and frequency were more closely related to dietary intake than food store access (as indicated by geographical proximity). Therefore, the current study aims to examine the likely influence of the food environment by assessing the frequency of shopping in a range of different types of food stores (traditional markets, small shops, small cafes, street food vendors, and modern food stores).

In Indonesia, several types of food stores exist among urban poor populations. There are street food vendors providing fritters and energy-dense dishes, small shops (*warung*) providing snacks and beverages, small cafes (*warung makan*) providing main meals, modern food stores (including franchised convenience shops and supermarkets), and traditional markets providing raw foods. Small cafes and modern food stores provide both energy-dense and nutrient-dense foods. Street food vendors and small shops (*warung*) are more likely to provide energy-dense foods. On the other hand, traditional markets may play a key role in facilitating access to foods rich in micronutrients for urban poor people.¹⁶ More specifically, the present study was conducted in Jakarta, a megalopolis with pockets of urban slums spread between high-rise buildings. Jakarta has the third highest prevalence of adult obesity and the highest prevalence of abdominal obesity among all Indonesian provinces.¹⁷ Between 2010 and 2013, there was a 2-fold increase in the prevalence of obesity among women in Jakarta (13.9% to 32.9%).¹⁸

Because both healthy and less healthy food stores are available, we investigated food store choice among urban slum women and its relation to the quality of their food consumption. It is expected that findings from the study will provide useful insights for the development of interventions to improve urban slum food environments.

Methods

Study Design

The present cross-sectional study was conducted in Kampung Melayu, the subdistrict with the highest poverty index among urban slums in East Jakarta.

Study Sample

Eligible participants were 19 to 50 years old, with BMI ≥ 18.5 kg/m², a food provider (involved in purchasing and providing food at home), able to communicate well, not pregnant, and not handicapped or disabled. From a total of 200 interviewed individuals, 5 with extreme BMI (BMI > 55 kg/m²) were excluded; 7 more were excluded because they reported lower- or higher-than-plausible energy intakes (< 600 kcal or > 5000 kcal). Therefore, the analysis was performed on 188 individuals.

Sample Size Estimates

Sample size was calculated by formula for estimating the correlation between food consumption (gram/day) and food store (frequency/month) in a cross-sectional survey, with a 95% CI.¹⁹ The correlations were assumed at 0.4 (fair correlation) because previous studies on the correlations between food consumption and food stores were unknown. A design effect of 2 was used to take into account variation between the hamlets (the smallest neighboring unit used as cluster). After allowing for a 10% nonresponse rate, the minimum sample size was 137 individuals.

Pretesting

Pretesting was done to assess whether the semiquantitative food frequency questionnaire (SQ-FFQ), the questionnaire (for socioeconomic status [SES], frequency of buying food in food stores, and nutrition knowledge), and nutritional status assessment could be administered effectively. A total of 30 respondents were interviewed from 2 hamlets in Kampung Melayu village. Data gathered from pretesting (of the SQ-FFQ and the questionnaire) were evaluated. As a result, some new answers and food items were added to the questionnaire and SQ-FFQ. The amended SQ-FFQ and questionnaire were used in the main survey.

Data Collection Procedure

The survey took place between March and April 2015 in 5 hamlets different from the pretesting areas. The individuals were selected randomly from the Family Card (card owned by every family that provides demographic data of family members), which had been collected by voluntary community health workers. Selected individuals underwent anthropometry assessment. Afterward, those who were eligible were interviewed at their home by a trained enumerator to obtain data on food consumption, socioeconomic status (SES), frequency of buying food in food stores, and nutrition knowledge. The detailed procedures are explained below:

Nutritional Status. Anthropometry measurements were made using standard methods.¹⁷ The Shorr Board was used for measuring height and TANITA weighing scale for body weight and body fat percentage.

Food Consumption. Food consumption over the previous month was obtained from a SQ-FFQ, which was adapted from a previous study in an urban slum in Jakarta.²⁰ Each food item had a response frequency scale of per day, per week, or per month. Interval frequencies were rounded up (eg, 1-2 times/wk, was calculated as 2 times/wk). The national standardized food photograph book was used to estimate the portion size.²¹ The calorie content of each food item was analyzed using dietary software (NutriSurvey for Windows, version 2007, Dr Juergen Erhardt, SEAMEO-TROPMED RCCN-Universitas Indonesia). Moreover, amount of food consumed (gram/day)

Table 1. Description of Food Stores That Were Accessible in the Study Site.

Food Stores	Description
Traditional markets	Wet markets and mobile food sellers (usually roaming around the neighborhood) that provide raw foods (ie, fruits, vegetables, meats, and fish)
Warung makan/ small cafes	Small places that provide a variety of daily cooked food (ie, rice, vegetable dishes, fried soybean products, animal product dishes)
Street food vendors	Portable food carts/nonpermanent stalls that provide mixed dishes or fritters/fried snacks
Warung/small shops	Permanent or semipermanent stands that provide manufactured foods and beverages, fritters, fruit juices, or nonperishable foods (eg, sugar, flour)
Modern food stores	Including franchise convenience shops (small self-service stores) and supermarkets

and percentage energy contribution were reported for basic food groups (such as staple food, snack, fried soybean product, mixed dishes, animal products, beverage, fruit, and vegetables).

Frequency of Buying Food in Different Types of Food Stores. Observation of the local food environment had been done prior to the study. Through this observation, 5 types of accessible food stores (Table 1) were classified according to types of foods they sold (ie, traditional markets, small cafes [*warung makan*], small shops [*warung*], street food vendors, and modern food stores [franchise convenience stores and supermarkets]). Participants were asked how many times they had bought food from those food stores within the past month (probed by asking frequency within a week and a month).

Nutrition Knowledge. Nutrition knowledge questions were adapted from a larger study about food providers' perceptions and weight control in 5 countries.²² Some questions were modified to be more relevant to the experiences of poor urban women. There were 18 questions with 5-point Likert Scale responses (scale of 1 to 5) to assess the women's perceptions of the causes of obesity, healthy eating behavior, and the healthiness of selected food products.

Socioeconomic Status. SES of participants was assessed through the ownership of household assets (safe source of drinking water, fuel for cooking, private bathroom, standard toilet facility, septic tank, electricity, motorcycle, television, water heater, 12-kg liquid petroleum gas, refrigerator, and car).¹⁸

Data Analysis

Both data entry for SQ-FFQ in Microsoft Excel and in SPSS version 20 (IBM Corp, Armonk, NY, for the structured questionnaires) were done by a trained enumerator and a researcher (RA). Data cleaning was conducted by a researcher (RA). Food consumption (gram/day) was calculated using Microsoft Excel, and energy intake was analyzed using NutriSurvey. Food consumption and energy intake were imported to SPSS for further statistical analysis.

The association between food consumption (gram/day) and food store choice (frequency of visit/month) was estimated by linear regression, with adjustment for age, SES, and nutrition knowledge, and presented using a standardized β coefficient.

The nutrition knowledge of the participants was evaluated based on the correctness of their responses to the knowledge questions. The women's answers were classified as correct and scored 1, and neutral/not sure; wrong answers were classified as false and scored 0. The sum of

Table 2. Participant Characteristics (n = 188).

Characteristics	Mean (SD)	n	Percentage
Age (years)			
19-30		39	20.7
31-40		97	51.6
41-50		52	27.7
Body fat percentage ³⁰			
<30% (normal)		14	7.4
≥30% (obese)		174	92.6
Nutritional status ¹⁷			
Normal (18.5 to <23 kg/m ²)		27	14.4
Overweight (≥23 to <27.5 kg/m ²)		80	42.6
Obese (≥27.5 kg/m ²)		81	43.1
Marital status			
Single		0	0
Married		184	97.9
Widow		4	2.1
Educational level			
Never went to school		2	1.1
Elementary school		27	14.4
Junior high school		61	32.4
Senior high school		93	49.5
University		5	2.7
Working status			
Working		32	17
Nonworking		156	83
Socioeconomic status score ^a	7.8 (1.9)		
Nutrition knowledge score ^b	13.7 (2.3)		
Poor		51	27.1
Fair		58	30.9
Good		79	42

^aA composite score derived from ownership of household assets.

^bNutrition knowledge score regarding cause of obesity, healthy eating behavior, and healthiness of some food products was divided by tertile.

the correct answers was divided into tertiles and used to define poor, fair, and good knowledge. A SES score was calculated based on the ownership of household assets.¹⁸ Both scores were treated as confounding factors in multiple regression analyses of food consumption.

Results

Table 2 shows that 85.7% of the study participants were overweight and obese. The majority were married, with secondary high school education, and not working in paid employment. The average SES score was 7.8, which means that approximately 8 of 12 household assets were owned by the average study participant. In all, 42% of the participants were able to answer correctly 15 of the 18 nutrition knowledge questions during the interviews (mean score ± SD = 13.7 ± 2.3).

The study site is surrounded by many kinds of food stores, which we differentiated into 5 types. Figure 1 shows the mean frequencies of buying food from the different types of food

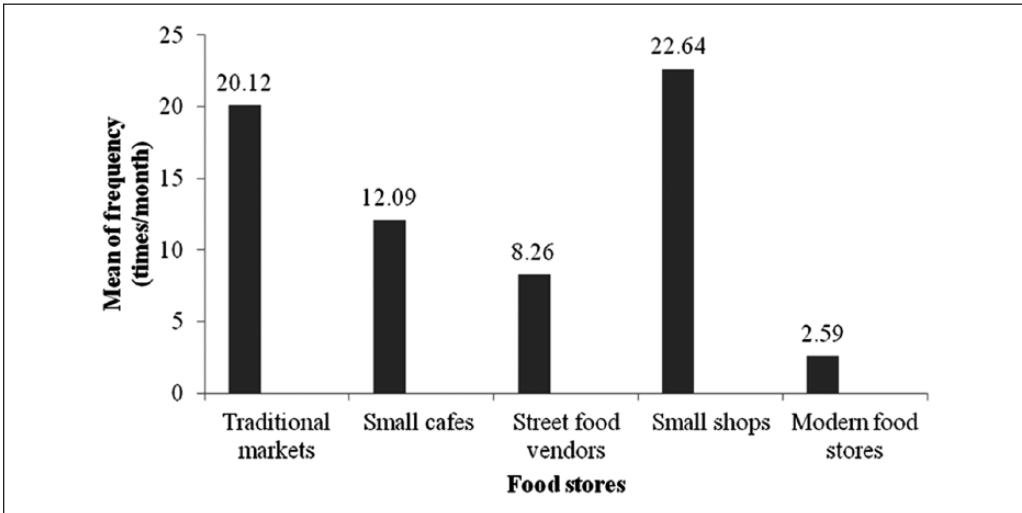


Figure 1. Frequency of buying food from each food store in a month.

stores. The most visited stores were traditional markets and small shops (*warung*), which were visited almost every day. Small cafes (*warung makan*) and street food vendors were visited approximately 2 to 3 times a week; modern food stores (franchise convenience stores and super-markets) were the least visited by the participants.

Food Consumption

The food items included in each of the food groups are described in Table 3. The staple food group was consumed most (± 400 g/d), followed by beverages (± 300 mL/d), and snacks (± 200 g/d). The staple food group contributed most of the energy intake ($\pm 30\%$). Snacks contributed $\pm 17\%$, followed by fried soybean products (10.9% of the energy intake) and mixed dishes (9% of the energy intake). Beverages, the second most consumed group, contributed almost 8% of the energy intake. In the current study, milk and other milk products were included in beverage group. However, milk was rarely consumed, and the most consumed beverages were tea and coffee (both contained sugar).

Food Consumption and Food Store Choice

Table 4 shows that street food vendors, small shops (*warung*), and modern food stores were significantly associated with food consumption. Consumption of snacks, the second contributor to energy intake, was significantly associated with small shops (*warung*). Consumption of mixed dishes was significantly associated with buying food from street food vendors. Modern food stores were significantly associated with fruit consumption. In addition, energy intake (based on SQ-FFQ data) was significantly associated with buying food from small shops (*warung*). In contrast, consumption of staple food, fried soybean products, animal products, beverages, and vegetables were not significantly associated with any food store.

Discussion

To explore the likely contribution of the food environment on food consumption that may lead to obesity, this study excluded underweight women. Although the study participants were randomly

Table 3. Food Group Descriptions, Food Consumption, and Percentage Energy Contribution.^a

Food Groups	Food Items	Consumption Per Day, ^b Median (IQR)	Percentage Energy Contribution (%), ^c Median (IQR)
Staple food	Rice, boiled noodles, chicken porridge, steamed rice with coconut milk, sticky rice	433 (301-626)	29.2 (19.8-39.3)
Snacks	Traditional snacks (<i>bika ambon</i> , <i>lumpur</i> , <i>dadar gulung</i> , <i>lemper</i> , <i>putu ayu</i> , <i>putu</i>); bun; doughnut, fried banana, chips, rissoles, <i>batagor</i> , <i>pempek</i> , <i>cireng</i> , <i>pastel</i> , <i>martabak</i> , <i>rempeyek</i> , <i>cakwe</i> ; biscuits, crackers, wafer; ice cream, mung bean porridge, <i>es campur</i> , <i>bubur sumsum</i> , <i>kolak</i> ; fried cassava/sweet potato/potato	227 (129-363)	17.4 (11.2-24.0)
Fried soybean products (plant protein)	Fried tofu/sweet fried/stir-fried tempe/tofu, stirred <i>oncom</i>	104 (50-172)	10.9 (6.5-17.2)
Mixed dishes	Fried rice, fried <i>kwetiaw</i> /rice noodles, meatballs, dumpling, <i>soto daging/babat/ayam</i> , <i>lontong sayur</i>	123 (73-242)	9.0 (5.0-13.3)
Animal products (chicken, meat, egg, organ)	Fried/grilled chicken, chicken nugget, boiled chicken/meat with coconut soup, chicken/beef satay, fried/grilled sausage; fried/stir-fried gizzard/liver, stir-fried/soup of cow's soft bones, fried chicken intestine, fried cow lungs; fried/boiled chicken/quail/duck eggs; fried/grilled/steamed fish, stir-fried/fried squid, fried prawn, salty fish, stir-fried anchovy	119 (79-189)	7.8 (5.6-11.0)
Beverages (mL/d)	Sweet/sweetened beverages, soft drinks, juice products; tea/coffee beverage; milk, cereal, yogurt, milk powder, sweet condensed milk	321 (216-521)	7.7 (3.9-14.5)
Fruit	Fruit, fruit juices, and mixed fruit dishes	124 (69-207)	3.4 (1.7-5.7)
Vegetables	Raw/boiled/stir-fried/with coconut milk vegetable; mixed vegetable dishes	118 (65-198)	3.1 (1.9-4.8)

^aFood descriptions: *oncom* (fermented beans), *bika ambon* (tapioca cake with coconut milk), *lumpur* (flour cake with coconut milk), *dadar gulung* (egg roll with chicken filler), *lemper* (sticky rice with chicken floss), *putu ayu* (flour cake with coconut), *putu* (flour cake, coconut, and brown sugar), *batagor* (fried dumpling with coconut sauce), *pempek* (fried fish cake), *cireng* (deep fried tapioca), *pastel* (fried vegetable Indonesian pastry), *martabak* (deep fried beef and vegetable wrap), *rempeyek* (crispy peanut fritters), *cakwe* (fried breadstick, *soto daging/babat/ayam* (noodle soup with meat/intestine/chicken), *ketoprak* (mixed vegetables with peanut sauce), *lontong sayur* (rice cake, boiled egg, vegetable in coconut milk), *es campur* (mixed fruit ice dessert), *bubur sumsum* (rice flour porridge with brown sugar sauce), *kolak* (banana/cassava/sweet potato in coconut milk).

^bFood consumption (gram/day) was assessed by semiquantitative food frequency questionnaire (SQ-FFQ).

^cEnergy intakes was calculated by *NutriSurvey* dietary assessment software according to SQ-FFQ results.

chosen, surprisingly, the proportion of normal women was much smaller than that of overweight and obese women. This finding highlights the nutrition transition that is recently experienced by developing countries in which obesity has been shifting toward the poor.²³

Like most urban slums, this study site is heavily populated and has limited space for own production of fresh products. Families obtained food by purchasing either raw food or cooked

food. A recent review showed that many urban slum dwellers do not utilize modern food stores (such as franchise convenience stores and supermarkets) but prefer traditional markets as their main source of food.¹⁶ The same pattern emerged in the present study. Traditional markets, providing all kinds of fresh food, were visited almost every day.

Regarding the overall food environment, the present results are quite consistent with findings from other investigations. Urban slum residents have very good access to stores providing less healthy food (eg, small shops and street food vendors) within walking distance, and they shop in the stores frequently.^{1,9,24,25} Based on our field observations, small shops (*warung*) were widely available in the study area. Indeed, many of the residents had opened small shops in front of their houses and sold beverages and snacks. The other food stores are small cafes (*warung makan*) and street food stores. Both provided cooked food, and the street food vendors tended to offer fewer vegetable dishes.

Because these small stores seldom provide healthy food choices, they offer shoppers fewer opportunities to meet dietary guidelines.^{1,24} Compared with the Indonesian Dietary Guidelines (Pedoman Gizi Seimbang/PGS),²⁶ consumption of staple food, plant protein, and animal products met the guidelines (ie, 3-8 portions for staple food, 2-3 portions for plant protein, and 2-3 portions for animal products). However, consumption of fruit and vegetables did not fulfill the recommendations (2-3 portions of fruit and 3-5 portions of vegetables). The Indonesian Dietary Guidelines also have recommendations for maximum consumption of salt, sugar, and oil (no more than 4 spoonfuls of sugar, 1 teaspoon of salt, and 5 spoonfuls of oil per day). Because the consumption of sugar, salt, and oil was not recorded in the present study, it is uncertain whether the study participants met these recommendations.

A substantial proportion (35%) of daily dietary energy intake came from snacks, mixed dishes, and sugar-sweetened beverages. This pattern of consumption is consistent with another study that found that the consumption of energy-dense foods (ie, fritters/fried snacks and sugar-sweetened beverages, especially home-prepared coffee and tea) among the Indonesian urban population was very frequent.²⁷ Patronage of small shops (*warung*) and street food vendors was significantly associated with the consumption of EDNP foods. These food sources are known to offer mostly inexpensive, energy-dense products.^{28,29} Also, low-income populations have to obtain daily calories at an affordable cost.² Therefore, it is not surprising that small shops (*warung*) were significantly associated with energy intake (Table 4).

Beside snacks and mixed dishes, the other food groups (except fruit) were not significantly associated with particular types of food stores. Staple foods, fried soybean products, animal products, and vegetables are sold in traditional markets and/or in small cafes (*warung makan*) as cooked food. Sugar-sweetened beverages, mostly tea and coffee, can be purchased from most food stores except from street food vendors. A key finding of this study was that fruit consumption was significantly associated with modern food stores. Fruit generally is expensive compared with other food groups; thus, low socioeconomic status could be expected to be associated with low fruit consumption, which was shown in this study. However, the association remained significant after SES was included in the regression analysis as a confounding factor. The similarity of SES could be the reason why adjustment by SES did not really mean so much. Unfortunately, the kinds of food bought from particular types of food stores were not recorded in the present study, so it is not possible to identify where the fruit was bought. This needs to be examined in future research.

Given that nutrition transition is currently emerging in the urban slum population in Jakarta, there is an urgent need to address this issue. Further studies need to be conducted that explore the preferred channels for nutrition education and community perception on how to change their diet, as a first approach. The second approach is modifying the food environment. The current study shows that EDNP foods are part of urban slum dwellers' diets and that they are associated with small shops (*warung*) and street food vendors. For that reason, these 2 types of food stores

Table 4. Regression Models Examining Association Between Food Stores and Food Consumption.^a

Food Stores (Frequency/ month)	Food Consumption (g/d)								
	Energy Intake	Staple food	Snacks	Fried Soybean Products	Mixed dishes	Animal Products	Beverages	Fruit	Vegetables
	Standardized β Coefficients								
Traditional markets	0.071	-0.054	0.079	0.062	-0.041	0.125	0.094	0.137	0.077
Warung makan/ small cafes	0.092	0.062	0.062	0.107	0.068	0.04	0.064	-0.01	0.078
Street food vendors	0.083	0.097	0.125	-0.131	0.222**	-0.016	-0.034	-0.053	0.065
Warung/small shops	0.175*	0.007	0.187*	0.053	0.087	0.048	0.077	0.061	-0.035
Modern food stores	0.126	-0.097	0.051	0.148	0.059	0.142	0.019	0.214**	0.088

^aLinear regression analysis; * $P < .05$, ** $P < .01$, *** $P < .001$. Models are adjusted for age, nutrition knowledge, and socioeconomic status.

are important channels for interventions to improve the nutritional content of slum dwellers' diets. Interventions should aim to increase the availability of healthier foods. Collaboration with community stakeholders is required to bring this about. Some potential interventions may include the following: (1) work with "ibu PKK" (community family welfare) to open small shops (*warung*) and small cafes (*warung makan*) that provide healthy food (eg, fruit, vegetable dishes), (2) put "healthy" banners and signs to alert purchasers to the availability of healthy products in small shops and cafes that provide healthy choices, (3) provide calorie stickers (labeling of the calorie content of products) for street food vendors to raise public awareness of the calorie content of foods in their surroundings, (4) increase awareness of obesity among women through routine body weight and body fat monitoring using existing community health channels, and (5) collaborate with volunteer community health workers to ensure the sustainability of the program. A pilot study is needed to examine the feasibility and impact of these and similar interventions.

Some limitations of this study should be noted. First, it was a cross-sectional study; therefore, causal inferences between the variables cannot be made. Second, the kinds of food purchased from particular types of food stores were not recorded.

Conclusion

Small shops (*warung*) and street food vendors were widely available in the urban slum study area, and they significantly contributed to women's EDNP food consumption (particularly snacks and mixed dishes). The findings suggest that these small stores may be useful communication channels for the promotion of healthy eating.

Declaration of Conflicting Interests

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