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Review Article

Nutritional contribution of street foods to the diet of people in developing countries: a systematic review

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Abstract

Objective: To review studies examining the nutritional value of street foods and their contribution to the diet of consumers in developing countries.

Design: The electronic databases PubMed/MEDLINE, Web of Science, Cochrane Library, Proquest Health and Science Direct were searched for articles on street foods in developing countries that included findings on nutritional value.

Results: From a total of 639 articles, twenty-three studies were retained since they met the inclusion criteria. In summary, daily energy intake from street foods in adults ranged from 13 % to 50 % of energy and in children from 13 % to 40 % of energy. Although the amounts differed from place to place, even at the lowest values of the percentage of energy intake range, energy from street foods made a significant contribution to the diet. Furthermore, the majority of studies suggest that street foods contributed significantly to the daily intake of protein, often at 50 % of the RDA. The data on fat and carbohydrate intakes are of some concern because of the assumed high contribution of street foods to the total intakes of fat, *trans*-fat, salt and sugar in numerous studies and their possible role in the development of obesity and non-communicable diseases. Few studies have provided data on the intake of micronutrients, but these tended to be high for Fe and vitamin A while low for Ca and thiamin.

Conclusions: Street foods make a significant contribution to energy and protein intakes of people in developing countries and their use should be encouraged if they are healthy traditional foods.

Keywords
Street foods
Developing countries
Dietary intake
Nutritional value
Traditional foods

> '*The potential of street foods for improving the food security and nutritional status of urban populations remains almost totally unexplored.*' (Draper, 1996)[1]

Globalization is affecting food systems around the world by means of urbanization, increasing incomes, foreign investment and market liberalization[2]. Due to rapid urbanization taking place in many developing countries, street foods have become increasingly important as an income-generating strategy and as a fast and economical meal option. Since entry into the field is largely unregulated and does not cost much upfront investment, it has become an increasingly popular way for families, and specifically women, to earn a living[2].

Street foods have been defined as: 'ready-to-eat foods and beverages prepared and/or sold by vendors and hawkers especially in streets and other similar places'[3]. This includes foods sold within and around schools which are not from school canteens or restaurants. Mwangani *et al.* define street foods as: 'ready-to-eat foods and beverages, processed or fresh, which are sold at stationary locations or by mobile vendors in streets and open places as opposed to stores and licensed establishments'[4]. To differentiate street food vendors from formal sector food establishments, such

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as restaurants, a further qualification is added that street foods are sold on the street from 'pushcarts or baskets or balance poles or from stalls or shops having fewer than four permanent walls'[5]. In the present study we also included kiosks which did not include permanent walls.

Chakravarty and Canet[6] classified street food vending into three general groups. These include: (i) an operation where the vendor prepares food at home and brings it to the food stall to sell; (ii) foods prepared and sold at the food stall; and (iii) foods prepared in a cottage type of factory and brought to the stall for sale. Foods processed and packaged by industrial factories provide a further and usually more recently vended group of street foods (e.g. packets of crisps, candy, biscuits and soft drinks). Selling generally takes place at a fixed location. However, many vendors move around with their equipment and wares, frequenting places where consumers are concentrated such as bus terminals, stations and garages[6]. Outdoor foods sold by vendors are either eaten on the spot or taken home.

Despite the fact that street foods have been sold for numerous decades and provide a source of income to many families, there is a dearth of data regarding the contribution of street foods to the nutritional value of the diet. It is essential for policy makers and nutrition educators to have a good understanding of the type and nutritional value of street foods since their consumption in many countries has become entrenched in habitual eating patterns and may influence the development of non-communicable diseases and other nutrition-related conditions in the population. This is especially important in terms of the increase in the prevalence of obesity in many developing countries, particularly the increase in children and adolescents[7,8]. The objective of the present review was hence to obtain street food surveys in the peer-reviewed literature that have documented the contribution of street foods to dietary intake and to determine the significance of street foods in the diet.

Methods

The review was undertaken to obtain and examine studies on street foods in developing countries that included data on the nutritional value of street foods.

Types of studies

To be eligible for inclusion in the review, studies had to:

1. describe the nutritional contribution of street foods to the diet in terms of (i) nutritional value of foods or (ii) types of food groups consumed;
2. study foods sold by vendors in developing countries (as defined by the World Bank)[9]; and
3. be published in peer-reviewed journals up to and including March 2012.

Information on the types of food items sold, frequency of street food consumption and association with socio-economic status (SES) is presented when available in the articles eligible for inclusion.

Studies were excluded when they:

1. were not in the peer-reviewed literature (e.g. reports and workshop proceedings);
2. focused on street foods consumed in developed countries;
3. focused on foods consumed in traditional venues such as restaurants and canteens;
4. included food items purchased from licensed fast-food outlets; and
5. included foods consumed by institutionalized adults.

Outcome measures

The purpose of the review was to elicit data on street foods and their contribution to the nutritional value of the diet. Nutritional data included any of the following: energy intake; percentage contribution to daily energy intake (%EI); macronutrient intake; micronutrient intake; dietary diversity; and food groups.

Types of participants

Studies that had a general population approach were included in the review.

Search strategy

The research team searched the electronic databases PubMed/MEDLINE, Web of Science, Cochrane Library, Proquest Health and Science Direct. The search term used in all databases was 'street food'. This broad term 'street food' [All Fields] was used in an attempt to cover all articles on street foods due to the scarcity of peer-reviewed literature in this field. Manual searching of abstracts was then done to find those which included data on nutritional value of street foods.

Identification of relevant studies

Three reviewers (N.P.S., J.H. and Z.M.) independently assessed the retrieved titles (step 1) and abstracts of selected titles (step 2) by assessing the relevant articles for inclusion against the criteria described earlier. Full-text articles were obtained of those studies that were eligible for inclusion in the review based on the abstract. Data from studies that met the inclusion criteria and did not meet any exclusion criteria after reading the full article were extracted by one reviewer (N.P.S.) into structured summary tables (step 3) and checked by two reviewers (Z.M. and J.H.; step 4). Studies that were published as separate papers were included as being one study when the sample size, authors and geographic areas were the same.

Data synthesis

Each study was summarized and described with regard to: (i) the nutritional contribution of street foods to the

diet in terms of %EI and/or percentage of the RDA of macro- or micronutrients provided; (ii) the types of food groups supplied by street foods; (iii) the frequency of street food consumption; (iv) the type of street foods consumed; and (iv) data on SES associated with street food intake. These data are presented in Tables 1–3.

Results and discussion

The search of peer-reviewed literature was undertaken in January–March 2012 according to the process described in Fig. 1. After removing studies which did not meet the inclusion criteria and duplicates, we were left with twenty-three studies. These were classified into nineteen studies from sub-Saharan Africa and four from other developing countries. All studies found were descriptive cross-sectional studies.

Nutritional contribution of street foods

The majority of studies demonstrated that street foods contributed significantly to the diet of children and adults in developing countries, both in terms of energy, protein and micronutrient intakes and in terms of food groups consumed (Table 1)[3,4,6,10–29].

Energy and nutrient intakes

In terms of nutrient contributions from street foods, the highest contributions of street foods to daily energy intakes in adults were found in Abeokuta in Nigeria (50·3 %EI in males; 48·3 %EI in females)[13], Ougadougou in Burkino Faso (46 %EI)[26], Nairobi in Kenya (27–36 %EI in males; 13–22 %EI in females)[22], Uganda (22·4–25·6 % EI)[29] and Bamako in Mali (18·3 %EI)[15–17]. In children, numerous studies including those in Cotonou in Benin (40 %EI)[3], Nairobi in Kenya (13·4–22·4 %EI)[22], Port-au-Prince in Haiti (25 %EI)[10], Bamako in Mali (18·3 %EI)[15–17], Hyderabad in India (19 %E)[11] and rural areas of Kenya (13·5–20·8 %EI in males; 12·8–17·3 %EI in females)[25] have demonstrated the contribution of street foods to daily energy intake. Moreover, it is important to realize that the energy supplied by street foods usually serves as a replacement for home meals[30]. Furthermore, it needs to be recognized that should the energy from street foods be added to that from regular meals taken at home there may be an increase in energy intake which in the long run will impact detrimentally on weight status.

In terms of protein intake there are fewer data available. In Haiti, street foods contributed 16 % of the protein RDA in secondary-school children[10]. In Nigerian adolescents, average daily protein intake (62 g) from street foods provided more than 50 % of the RDA[12]. In Nigerian adults, street foods contributed 53·2 % of males' and 50·7 % of females' total daily protein intake[13]. Similarly, in Nairobi, meals sold to workers provided more than 50 % of the RDA for protein[14]. A study in Mali found that street foods provided 41 %, 19 % and 9 % of daily protein intake in persons of high, middle and low SES, respectively[16]; while a study in Uganda found that street foods contributed 38·6–44·9 % to daily total protein intake[29]. In Calcutta a typical street meal comprised 20–30 g of protein as measured by proximate analyses[6]. Overall, the majority of studies suggest that street foods contribute significantly to the daily intake of protein, often as much as 50 % of the RDA.

Fewer data are available on fat and carbohydrates. In Cotonou, more than 40 % of fat and carbohydrates came from street foods[3]. Daily fat intake from street foods was higher in the affluent group, 20–30 %, compared with 15 % in the low-SES group[3]. In Nigerian adults street foods provided 37·9 % and 54·0 % of total daily intake of fat and carbohydrates, respectively[13]. In Nigerian adolescents street foods provided 70·8 % and 24·8 % of total daily fat and carbohydrate intakes[12]. In Burkina Faso, a study reported on the adequacy of women's diet. Findings were that ready-to-eat foods bought outside the home provided 52 % of daily fat intake and 72 % of sugar intake[26]. In adults in Uganda, street foods accounted for 70·1–93·4 % of daily energy intake and fat contributed 21·9–26·3 %EI[29]. In Calcutta, an average street food meal of 500 g comprised 12–15 g of fat[6]. The data on fat and carbohydrate intakes are of some concern in terms of the high contribution of street foods to the total intakes of fat and sugar and their role in the development of obesity and non-communicable diseases.

A few studies have provided limited data on the intakes of micronutrients. Among adults in Abeokuta, street foods contributed 35·2 % of Fe intake, 46·2 % of Ca, 55·3 % of vitamin A, 57·3 % of vitamin C and 47·5 % of thiamine intake (total daily intakes)[13]. In adolescents, street foods contributed 64 % of calcium intake, 50 % of Fe, 60 % of vitamin A, 5·5 % of thiamin and 5·5 % of vitamin C intake (total daily intakes)[12]. However, a study in Bamako found that Ca (2·7–8·7 %) from street foods made only a small contribution while vitamin A from street foods made a large contribution (70–278 %)[15–17]. Few studies on street foods have actually analysed their nutrient content by proximate chemical analyses. Similarly, there is a dearth of information on the micronutrient content of street foods.

Despite not having nutrient intake data for saturated fat, *trans*-fat, sugar (mentioned by a few studies) and salt, there are sufficient data on the types of food and their preparation to realize that these nutrients are found in many popular items purchased from street vendors. Street foods such as candy, chocolates, soft drinks, sweetened tea, cookies and pastries, fried fish and meat, fried bread dough and doughnuts, and crisps are items having one or more of the following: high sugar, high saturated fat, high *trans*-fat and/or high salt (Table 2). Yet, it should be acknowledged that healthy food items are also sold by many vendors; the most common ones being fruit,

Table 1 Studies which met the inclusion criteria for the review

Reference	Place	No. of participants	Age (years)	Gender	Methods
Webb and Hyatt (1988)[10]	Port-au-Prince, Haiti	174 from 15 secondary schools	Secondary-school children	M, F	FFQ
Chakravarty and Canet (1996)[6]	Calcutta, West Bengal	911	19–48	M, F	Interviews
Sujatha *et al.* (1997)[11]	Hyderabad, India	51 households	23–52	M	3 × 24 h recalls
Oguntona and Kanye (1995)[12]	Abeokuta, Nigeria	142 at 12 schools	Adolescents	M, F	3 × 24 h recalls & weighed food intake on sub-sample over 3 d
Oguntona *et al.* (1998)[13]	Abeokuta, Nigeria	116	18–30	M, F	4 × 24 h recalls
Korir *et al.* (1998)[14]	Nairobi, Kenya	12 vending sites	Adults	N/A	Analyses of meal samples from vendors
Ag Bendech *et al.* (1998, 1999, 2000)[15–17]	Bamako, Mali	74 households & 367 persons	All ages	M, F	24 h recall; qualitative interviews
Levin *et al.* (1999)[18]	Accra, Ghana	559 households & 2835 persons	All ages	M, F	Questionnaire
Oguntona and Tella (1999)[19]	Abeokuta and Odeda, Nigeria	197 market women	Adults	F	3 × 24 h recalls & structured questionnaire
Mwangi *et al.* (2001, 2002)[4,20]	Korogocho (slum), Dandora (low–middle income) and industrial area; Nairobi, Kenya	580 vendors in 3 locations	Adults	M, F	Questionnaire & focus groups
Van 't Riet *et al.* (2001)[21]	Korogocho (slum) and Dandora (low–middle income); Nairobi Kenya	1011 households; sub-sample 73	All ages	M, F	Structured questionnaires
Van 't Riet *et al.* (2002)[22]	Korogocho (slum) & Dandora (low–middle income); Nairobi, Kenya	641	Adults; children 9–14	M, F	3 × 24 h recalls
Van 't Riet *et al.* (2003)[23]	Korogocho (slum) & Dandora (middle income); Nairobi, Kenya	495	Adults	M, F	3 × 24 h recalls
Badrie *et al.* (2005)[24]	Trinidad, West Indies	200 consumers & 6 sites selling 'doubles'	Adults	M, F	Nutrient analyses of 'doubles' & questionnaire completed by consumers
Gewa *et al.* (2007)[25]	Rural areas, Kenya	150	Schoolchildren	M, F	2 × 24 h recalls in 2 seasons
Nago *et al.* (2010)[3]	Cotonou, Benin	656 at 12 secondary schools	13–19	M, F	2 × 24 h recalls
Becquey and Martin-Prevel (2010)[26]	Ougadougou, Burkina Faso	182	19–69	F	3 × 24 h recalls
Steyn and Labadarios (2011)[27]; Steyn *et al.* (2011)[28]	South Africa (national study)	3827	>16	M, F	1 × 24 h recall
Namugumya and Muyanja (2012)[29]	Kampala, Jinja & Masaka; Uganda	225 street vendors	21–59	M, F	24 h recall & FFQ

M, males; F, females; N/A, not applicable.

Table 2 Nutritional value of street foods, frequency of consumption and types of foods consumed

Reference	Nutritional value of SF	Type of food groups consumed	Frequency of consumption	Types of food items consumed
Webb and Hyatt (1988)[10]	Mean energy intake 1928 kJ/d (401 kcal/d) and protein intake 5·8 g/d per person from SF; 25 % of energy and 16 % of protein RDA were provided by SF intake	Cereal food group accounted for 28·0 % of SF products; followed by fruit group at 18·5 % of products; sugars and syrups at 16·4 % of products	Not given	146 different food items of which 35 % were commercially produced; items included breads, fruits, home-made sweets, cooked foods, sugarcane, frozen ices, desserts, fried chips, beverages, commercial cookies, candies, baked items, peanuts
Chakravarty and Canet (1996)[6]	An average 500 g SF meal contained 20–30 g of protein, 12–15 g of fat and 174–183 g of carbohydrate and had an energy value of 4184 kJ (1000 kcal)	Not given	About 33 % of consumers purchased SF on a daily basis while 23 % patronized the stalls 1–4 times/week. In areas where office workers operated, SF was eaten about 5 times/week	*Lassi* (flavoured buttermilk); *idi* (rice and black gram flour dumplings); *dosa* (fermented rice & black gram flour pancake); vegetable curry; *alu kabli* (boiled potato with sour preparation)
Sujatha *et al.* (1997)[11]	Mean intake of foods eaten outside the home was 1975 (SD 238) kJ/d (472 (SD 57) kcal/d), corresponding to 19 %EI	Not given	Not given	These included beverages, sweetened tea, toddies (liquor), snacks (gram flour fried), meals (rice and pulses)
Oguntona and Kanye (1995)[12]	Mean energy intake was 10·85 MJ of which 25 % came from SF (29·4 % in males, 22·0 % in females). Over 50 % of total protein intake and 50 % of vitamins and minerals came from SF; 64 % of Ca came from SF	40–70 % of all food groups came from SF. The highest intake was cereals (mean 408 g/d); 50 % of meat & fish group and 60 % of legumes were from SF. Highest proportion of dairy group came from SF	Not given	Meat and fish fried with sauces on rice. Major legumes were cowpeas, bean cakes and roasted groundnuts. Fruit, yoghurt and chocolate milk-based drinks were also popular as snacks
Oguntona *et al.* (1998)[13]	SF contributed 50·3 % to males' and 48·3 % to females' energy intake. Intakes of micronutrients were generally <RDA except for Ca and vitamin A. Females had significantly higher Fe, thiamin and vitamin A intakes than males. Overall contribution of SF ranged from 23 % for Fe (males) to 80 % for vitamin A (males)	42–66 % of all major food groups came from SF with cereals being highest (261 g/d = 66 %) followed by roots & tubers (157 g/d = 51 %). Dairy food contributed 55 % and legumes 63 % of foods sold	Not given	Popcorn, roasted corn, bread, rice and doughnuts. Nearly 49 % of meat & fish came from SF in form of fried or stewed meat/fish served with vegetable stews or boiled rice, *eba* or *fufu* (fermented cassava) or *amala* (yam flour cooked to a paste). Legumes included *akara* (bean cake), *moin-moin* (bean pudding) and groundnuts. Also seasonal fruits and juices
Korir *et al.* (1998)[14]	Meals provided diverse energy content ranging from 16·8 to 36·7 % of RDA for age 18–30 years and from 17·8 to 38·3 % of RDA for 30–60 years. Except for chapatti and stewed vegetables, all meals provided more than 50 % of RDA for protein. *Githeri*-based meals had the highest mean energy per meal. The lowest energy per meal was for chapatti and stewed vegetables. *Githeri* and *matumbo* provided the most protein per meal	Not given	Not given	*Githeri* (maize & beans), chapatti (flat unleavened fried bread), *uji* (porridge from cereal flours such as finger millet and sorghum), *kienyeji* (maize & beans with potatoes, bananas and green leafy vegetables, stewed vegetables), bean stew (boiled kidney beans), *mandazi* (fried bread dough), *ugali* (stiff maize porridge), *matumbo* (fried intestines), rice, potato/beef stew, green gram stew
Ag Bendech *et al.* (1998, 1999, 2000)[15–17]	SF provided 18·3 % of energy intake, 4·9 % of protein intake. Only a small contribution was made to Ca (2·7–8·7 %) but a large contribution to vitamin A (70–278 %). SF provided 561–1745 kJ/d (134–417 kcal/d) per person	Not given	Almost all persons had SF on a daily basis; 95·4 % of children <7 years, 91·6 % of 7–15 year olds and 73·3 % of adults ate SF at least once daily	Single dish with a base ingredient with a sauce at each meal (sauces provide heterogeneity of meals); fresh fruit in season such as mangoes; beverages; ice cream; groundnuts; cooked meals

Table 2 *Continued*

Reference	Nutritional value of SF	Type of food groups consumed	Frequency of consumption	Types of food items consumed
Levin *et al.* (1999)[18]	Mean energy available per adult equivalent was 11 046 kJ/d (2640 kcal/d). Energy in female-headed households was almost 10 % higher than in male-headed households (included SF consumption)	Not given	Not given	Maize, cassava, yams, plantains, rice, wheat, tomatoes, fish; 80 % of SF consumed in the form of staples
Oguntona and Tella (1999)[19]	Contribution of SF was 59 %EI. SF contributed 58–59 % to protein intake. Ca supplied by SF was 79–81 %. SF contribution to Fe intake was 57 %. Contribution of SF to vitamin intakes were above 50 % of RDA except for thiamin in the younger group (<49 years) and vitamin A in the older group (>49 years)	Legume-based foods were popular and was the highest food group consumed daily (520 g/d), followed by roots & tubers (450 g/d), then cereals (380 g/d)	63 % of daily food intake was from SF	Legumes: cowpeas, fried bean cake (*akara*), steamed cowpea paste (*moin-moin*), roasted groundnuts. Tubers: cassava, yams, coc-yams. Cereals: rice, maize, wheat. Wheat consumed as bead, pies, doughnuts and biscuits. Fruit in season – bananas, guavas, citrus, pawpaw. Vegetables, mainly okra and green leafy ones. Chicken, meat mainly offal, fish and milk drinks
Mwangi *et al.* (2001, 2002)[4,20]	Difficult to determine the nutritive contribution of SF. However a large variety of cooked foods and snack foods appeared to be available, so it is likely that SF makes a significant contribution to the energy intake of many adults and children. Findings were that filling meals were mostly associated with the low-income area, which is also indicative of better nutritional value where needed most	Just over half (53 %) of vendors sold food from only one group; 44 % sold cereals; 36 % (mostly men) sold only carbohydrate products. More vendors sold foods from different groups in the working area (53 %) than in the slum area (43 %). Micronutrient-rich products were sold mainly by women	Not given	Working areas: *githeri*, *uji*, chapatti, meat & vegetable stews, vegetables, fruits, peanuts, boiled maize, pastries, cookies, tea, bread, *mandazi*, *ugali*, sodas, cakes, sugar cane Schools: sweet snacks & goodies Residential area: upper middle, fried fish and roasted maize Lower middle: fried fish, pastries, chapatti, cooked maize, fried & roasted meat, soup Low-income area: *githeri*, *kienyeji* (maize, beans, potatoes, vegetables) chips, *ugali* (stiff maize meal) also as for lower–middle income group
Van 't Riet *et al.* (2001)[21]	Energy from SF ranged from 13 %EI for schoolchildren in Korogocho to 36 %EI for men in Dandora	Not given	SF consumption 3·6 d/week in Korogocho and 2 d/week in Dandora. 78 % of households in Korogocho and 53 % in Dandora consumed SF at least once weekly. SF consumed by all ages and both sexes (except infants <1 year). In both areas large households (>8 members) consumed SF more frequently than small ones (<3)	*Mandazi* (deep fried dough) most commonly eaten for breakfast; maize- or flour-based products; *githeri* (maize with beans)
Van 't Riet *et al.* (2002)[22]	Daily energy contribution from SF in men was 27·1 %EI in Korogocho and 36·2 %EI in Dandora. In women it was 15·4 %EI and 20·1 %EI in Korogocho and Dandora, respectively. In children it ranged from 13·4 %EI to 22·4 %EI, respectively. In Korogocho, SF contributed 15·2 % to protein, 27·1 % to fat, 14·6 % to vitamin A, 7·1 % to Fe and 18·2 % to Ca intakes. Intakes in children were similar. Higher intakes were found in men for each nutrient	Not given	In Korogocho, 71·2 % of men and 73·2 % of women were regular consumers of SF. In Dandora 86·6 % of men and 76·7 % of women consumed SF. Men consumed more SF over weekends while women and children did not	Not given

Table 2 *Continued*

Reference	Nutritional value of SF	Type of food groups consumed	Frequency of consumption	Types of food items consumed
Van 't Riet *et al.* (2003)[23]	Men had a higher proportion of daily energy from SF than did women (26 %EI *v.* 16 %EI, respectively). Contribution of SF to daily energy intake was higher in the slum area than the low–middle income area	Not given	Not given	Not given
Badrie *et al.* (2005)[24]	Based on a 8368 kJ/d (2000 kcal/d) diet, a 'double' provided 17 % of fat, 12 % of Na, 12 % of carbohydrate, 20 % of dietary fibre and 25 % of Fe intake	Not given	89·5 % of respondents ate 'doubles' (usually two at a time); 44 % because of cheap price, 32 % due to convenience and 24 % due to desirable taste	'Double' is a sandwich made of fried dough (*baras*) with a chickpea filling (*channa*)
Gewa *et al.* (2007)[25]	Total energy intake from SF foods was significantly higher in boys (13·5–20·8 %EI) than girls (12·8–17·3 %EI). Intake of 987 and 1540 kJ/d in dry and harvest seasons, respectively. SF contributed substantially to vitamin C (65 %) and vitamin A requirements (30–65 %)	Not given	Children reported consuming a median of 2 SF items daily, mostly single items	Fruit and starchy foods were most commonly consumed during both seasons. During shortage season wild fruits and avocadoes were most common, also sugarcane and hard candies. During harvest season ripe mangoes and corn-on-the-cob were most common
Nago *et al.* (2010)[3]	On average 40 % of energy, fat, protein, carbohydrate and fibre in the diet came from SF. SF were mostly consumed at breakfast and as afternoon snacks. Consumers had a low intake of fruits and vegetables and a high fat intake	Cereals and cereal products were the most consumed food group (734 g/d); followed by sweet foods (304 g/d), other beverages (176 g/d), then roots & tubers (174 g/d), fruits & vegetables (97 g/d), eggs & dairy (60 g/d), meat (53 g/d), fish (44 g/d), legumes (42 g/d). SF accounted for only 26 % of daily fruit & vegetable intake	Not given	Cereal group: wheat bread, maize-based dough and porridges, rice & pasta. Sweet foods consisted of energy-dense foods such as sweet beverages, candies, chocolate and lollipops. Starchy roots & tubers comprised yam- or cassava-based dough, boiled or fried yam, cassava, potatoes, sweet potatoes and bananas. Fruit included pineapples, apples and oranges, while green leafy vegetables were consumed in sauces. Eggs, milk & milk products were also popular
Becquey and Martin-Prevel (2010)[26]	Ready-to-eat foods provided 46 % of energy, 52 % of fat and 72 % of sugar intake. Micronutrients were inadequate for vitamins B_{12}, riboflavin, B_6, thiamin, folate, Fe, Zn and Ca. SF were not associated with micronutrient inadequacy. Mango and organ meat consumption significantly reduced the risk of micronutrient deficiencies	Consumption of certain food groups was associated with a lower mean probability of risk, namely organ meats, vitamin A-rich fruits & vegetables, legumes & nuts, and flesh foods	Not given	*Tô* (paste made from cereal flour of maize, millet or other) with okra; rice with peanut sauce; soft drinks – mainly *zoom-koom* (pearl millet flour with sugar); peanuts; buns/cookies; bread; alcoholic beverages; fruit – mainly mangoes
Steyn and Labadarios (2011)[27]; Steyn *et al.* (2011)[28]	Since fruit was most commonly consumed as a SF one can speculate that it would contribute to micronutrient intakes of those in high category of consumers, namely Africans. Frequent purchasers of SF had a significantly lower dietary diversity score (4·69) compared with lower consumers (3·81)	Not given	At national level 11·3 % of adults bought from street vendors at least twice weekly. Africans were the most common consumers with 19 % consuming SF at least twice weekly while whites had the lowest (2·9 %). The highest consumption took place in urban slums (19·4 %) and in urban formal areas (16·7 %). The lowest consumers were in rural areas (4·7 %). Frequent consumption of an item was defined as eating it $\geq$2 times/week	Fruits, soft drinks, savoury snacks (e.g. potato crisps), biscuits, cooked food (e.g. maize porridge or rice with or without meat)

Table 2 *Continued*

Reference	Nutritional value of SF	Type of food groups consumed	Frequency of consumption	Types of food items consumed
Namugumya and Muyanja (2012)[29]	The mean daily energy from SF varied between 22·4 %EI and 25·6 %EI (2412 kJ). Carbohydrates contributed the highest proportion of energy (70·1–93·4 %), followed by protein (38·6–44·9 %) and fat (21·9–26·3 %). SF vendors obtained 24·0–32·5 % of their RDA for Ca from street vended foods. Niacin and thiamin intakes from SF were respectively above 74 % and 150 % of RDA. The contribution of SF to RDA for Zn ranged from 81·9 % to 190·9 %, and from 35·0 % to 49·0 % for retinol. Fe intake from street vended foods contributed 40·9–49·7 % of RDA	The food groups consumed most commonly by SF vendors were energy and protein sources, namely cereals, roots & tubers, legumes, meats/fish	Not given	Traditional dishes were the most commonly prepared foods and classified into main meals, sauces, vegetables and snacks. Examples are boiled rice, steamed bananas, steamed sweet potatoes, steamed cassava, *posho*, millet bread, steamed yams, beef stew, fish stew, bean sauce, groundnut sauce, boiled amaranthus, fried cabbage

SF, street foods; %EI, percentage of energy intake.

legumes, dairy products and boiled vegetables. Certainly, health advocates should support and encourage the sale of such items.

In summary, energy intake from street foods in adults ranged from 13 %EI to 50 %EI and in children from 13 %EI to 40 %EI. Although the amounts differed from place to place, it should be borne in mind that even at the lowest values of the percentage of energy intake range, energy from street foods made a significant contribution to the diet. While the contribution of street foods to energy intake was reported frequently, much fewer data are available on macronutrients and micronutrients. The data available for Ca, Fe and micronutrients show that street foods tend to be high in Fe and vitamin A, but low in Ca and thiamin. No data were found on *trans*-fat, saturated fat and salt intakes.

Food groups

When discussing different food groups sold as street foods it needs to be recognized that urban dwellers have a more varied diet and consume more processed foods, animal protein and fats than rural dwellers[18]. Urbanites also have greater access to processed foods and markets. Some studies presented findings on the types of food groups sold in street foods for different countries. In Haiti, for example, 146 different street foods were identified in Port-au-Prince of which cereals and grains accounted for 28·0 %, fruit for 18·5 %, and sugars and syrups for 16·4 %[10]. In Abeokuta, 50 % of meat and fish, 60 % of legumes and an estimated 42–66 % of all major food groups came from street foods[12,13]. In Nairobi, in low-SES areas, more than half (53 %) of the vendors sold foods of only one group[20]. Overall 36 % sold only carbohydrate products in Kumba, Cameroon[31]. Furthermore, the type of foods sold differed from area to area. For example, both vendor-prepared foods and ready processed foods were sold in a low-income area in Tunisia, while in an industrial area many vendors also sold foods that needed no preparation[32].

Frequency of street food consumption

Frequency of street food consumption varied widely between countries and areas (Table 2). In Mali, for example, street foods were consumed on a daily basis[15–17]. Similarly, a study in Nigeria indicated that street foods provided more than 60 % of daily food intake[19], while in urban Kenya the intake appeared to be less with 53–78 % of households consuming street foods at least once weekly[21,22]; however, street food consumption was high in rural areas of Kenya, with schoolchildren eating street foods about twice daily[25]. A national study in South Africa reported that Africans were the most common consumers of street foods with 19 % consuming them at least twice weekly[27,28].

Type of food sold on the streets

It may be impossible to calculate the number of different street foods sold globally. Table 2 provides some idea of

Table 3 Association of street food consumption with socio-economic status

Reference	SF intake and SES
Webb and Hyatt (1988)[10]	Energy and protein intakes were highest in high- and middle-income tuition schools and in ages 16–19 years
Chakravarty and Canet (1996)[6]	Consumers spent RS 40–400/month on SF
Oguntona and Kanye (1995)[12]	There were no significant differences in energy intake between men of high or low mobility (distance to travel) within the low-SES group
Levin *et al.* (1999)[18]; Oguntona and Tella (1999)[19]; Mwangi *et al.* (2002)[20]	Daily expenditure on SF was highest in middle- and high-SES areas. For family heads and mothers, frequency of buying SF increased with declining SES level. Cost on energy basis was higher than home food. SF accounted for 19–27 % of food costs
Van 't Riet *et al.* (2001)[21]	Women's income-generating activities (66 %) were concentrated mainly in petty trading and in the preparation and sales of SF. Despite lower incomes and additional demands on their time as housewives and mothers, female-headed households, petty traders and SF vendors had the largest percentage of food-secure households. They also had a greater dependence on local SF for snacks and meals, given their constraints of time and the need to substitute labour-intensive foods for more readily available foods
Mwangi *et al.* (2001, 2002)[4,20]	Most (65·7 %) vendors were female with a mean age of 27·6 years; 78 % of vendors were also owners of the operation; 88 % of vendors sold their wares at stationary locations. Positive significant correlation found between the age of the business and both the number of food varieties and the number of people working on the site. On average each vending unit had 2·5 food varieties and 1·6 workers. The percentage of vendors selling more than one food group was highest in the industrial area (53 %), 43 % in the slum area and 21 % in the low–middle income area
Becquey and Martin-Prevel (2010)[26]	Employment status of household head and SF consumption were significantly related: when unemployed, SF intake was 3·7 d/week; when self-employed, SF intake was 2·9 d/week; and when regularly employed, SF intake was 2·1 d/week
Steyn *et al.* (2011)[28]	Employment status and distance to place of work were two determinants of SF consumption in men in Korogocho. Furthermore, men who were self-employed derived less energy from SF (17 %EI) than those who were casual labourers (26 %EI) or regularly employed (26 %EI). In women, having school-aged children and distance to work were determinants of daily energy from SF for women in Korogocho. Women with children derived less energy from SF than women without school-aged children (12 %EI *v.* 16 %EI). Women with an income of their own derived more energy from SF than women without an income of their own (22 %EI *v.* 13 %EI)
Dawson and Canet (1991)[34]	No socio-economic characteristics were significantly associated with low mean probability of adequacy of micronutrients
Piaseu and Mitchell (2004)[37]; Fourere *et al.* (2000)[38]	The highest frequent consumption (≥2/week) of SF was in the middle-SES category (14·7 %). The highest moderate consumption (2–3 times/month) was in low- and high-SES categories

SF, street foods; SES, socio-economic status; %EI, percentage of energy intake.

the wide variety of street foods available in different countries. Not only do they differ from country to country, but also by city and by vendors themselves. It appears that the bulk of items are based on traditional and cultural foods although foods processed by large-scale manufacturers are also an important category of items sold, particularly with regard to snack foods such as candies, chocolates, biscuits and crisps. Generally, vendors sell more than one kind of product although some specialize in one type only, such as bread with different fillings[1] or different soft drinks. Street foods can be grouped in various ways: by meal (with various constituents); by single food items or beverages; by level of processing; and by method of cooking (e.g. fried, boiled, baked, steamed or raw)[1].

Association of socio-economic status with street food consumption

It appears that food vendors target their range of food items to the SES of the area and the income level of the consumers (Table 3). For example, vendors sold more foods from different food groups in the working class area (53 %EI) than in the slum area of Nairobi (43 %EI)[20]. In Mali, 95·4 % of children ate street foods at least once daily[15–17]. The practice was highest in poorest and middle-SES groups[18–20]; however, expenditure on street foods was highest in middle- and high-SES areas[19]. A national study on street foods in South Africa[27,28] indicated that moderate street food intake was highest in the middle SES category (29·7 %) and in the frequent eaters (at least twice weekly) it was 14·2 %. These data suggest that street foods are sold in all SES areas although the type of items may vary according to the disposable income of the consumers.

Advantages of the street food trade

Street foods are usually economical, socially and culturally appropriate food items or meals. With many adults working long hours the use of street foods saves time in preparation of foods. Furthermore, street foods are usually available in small quantities and ingredients do not have to be purchased from the market for home food preparation. Fuel costs are generally high in developing countries and buying street foods saves not only on labour time but also on fuel costs. Furthermore, poor

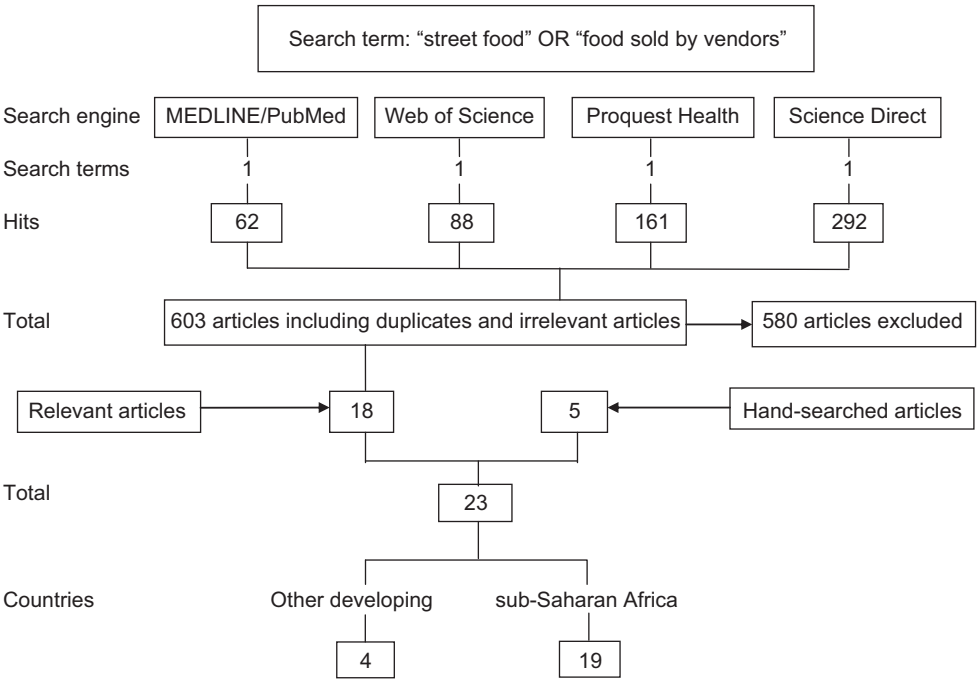

Fig. 1 Number of studies retrieved during the screening process

people often do not have adequate cooking facilities and space, hence purchasing ready-to-eat food is an advantage[4,33].

Another important advantage of the street food trade is that of income generation. Many illiterate and unemployed people, frequently women, find this a simple way to earn some money with little capital investment required. According to Dawson and Canet[34], among lower-income groups in many developing countries 50–70% of household earnings are spent on street foods. This also applies to schoolchildren, who may be given money to buy breakfast and/or lunch instead of being given cooked food or snacks[17]. Hence street foods also potentially contribute significantly to the diet of schoolchildren. Because of their widespread use, Draper[1] further recommends studying the feasibility of using street foods as vehicles for micronutrient fortification.

It appears that cooked foods (cuisines, in particular) have become tourist attractions in certain countries and are often hailed as being authentic and unique dimensions of culture, lifestyle and even heritage[35]. For example, in a study in Singapore, 65% of tourists agreed that street food centres had an appealing uniqueness and cultural significance[35]. Moreover, 58% of tourists indicated that street food centres/areas were their means of learning about Singapore heritage.

Negative connotations of the street food trade

Unfortunately the use of street foods has many negative connotations with regard to hygienic and safety issues, and in many countries this trade is not regulated, which means that bacterial contamination of such foods is of concern to many who buy these products. Numerous studies have documented these effects and certainly one would need to pay attention to addressing these issues before encouraging the sale of street foods[1].

An important concern that requires cognition when discussing street foods in developing countries is the westernization of diet, which has led to increased intakes of saturated fat, *trans*-fat, sugar and salt[3,36]. Women studied in Burkina Faso[26] showed some of these trends since food bought outside the home by them accounted for 52% of fat intake and 72% of sugar intake. In Tunisia more than 70% of children studied used 75% of their pocket money to buy street foods. Items bought most frequently were candy (27·2%), pastries (23·9%), sandwiches (23·9%), sunflower seeds and peanuts (21·0%), and either chocolate, pizza or cheese (20·0%)[32]. The largest proportion of money was spent on candy, pastries and sandwiches. The main motivation for buying street foods was to replace a meal at home. With the exception of peanuts and sunflower seeds, the other items did not reflect a traditional Tunisian diet and are typical examples of 'western foods'.

Conclusions

Street foods contribute significantly to the diet of many living in developing countries. Furthermore, street foods are convenient, cheap, easily accessible and a source of income to many poor people who would otherwise not

find employment. Health policy makers and educators should encourage and promote the sale of healthy, traditional street foods and ensure that regulation efforts are in place to prevent health problems arising. This may also include centres or areas where street foods are sold and which encourage tourists to sample local cuisine in a safe environment.

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