



Volume 8, Issue 1, January 2019, www.ijfans.com e-ISSN: 2320-7876

**INTERNATIONAL JOURNAL OF FOOD AND
NUTRITIONAL SCIENCES**

IMPACT FACTOR ~ 1.021



Official Journal of IIFANS

A REVIEW OF FOOD SAFETY KNOWLEDGE AND PRACTICES OF FOOD VENDORS AND VENDED FOODS

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Received on: 23rd November, 2018

Accepted on: 28th December, 2018

Street foods and drinks have a long tradition worldwide and are a universal phenomenon which has been an integral part of society in all country-underdeveloped, developing, or developed. There were limited scientific data officially published in the world, and most of those surveys or investigations were done in developing countries such as Africa, Asia, and Latin America. The related surveys of street vended foods and the concerns of all researchers were sorted and coordinated in this paper for researchers who are interesting in future street food study. Recommendations were also made for government authorities.

Keywords: Street vendor, Food hygiene, Safety knowledge

INTRODUCTION

Street vended foods, same as hawker foods, are usually prepared and sold in the street which are ready-to-eat or prepare-on-demand foods for on-site immediate consumption, or takeaways for later without further processing or preparation (Toh and Birchenough, 2000; Kubheka *et al.*, 2001; and Gadaga *et al.*, 2008). Various types of food can be sold in the streets and they are universal phenomena and important sources of income for vendors and foods for public consumptions (Tinker, 2003). Street foods used to be regarded as illegal but still significant growing during the past few decades (von Holy and Makhoane, 2006) and this growing of street food presents a new public health challenges due to the safety of food is difficult to practice at street level with evidences of diarrheal diseases linked outbreaks (Rheinländer *et al.*, 2008).

It was reported that in 1997, one million street food meals were purchased every day in Singapore and around 100,000 street-food vendors had been estimated in Malaysia and even large numbers in Peru (Estrada-Garcia, 1997). For lower

income countries, like Thailand and Nigeria and over a quarter in the Philippines and Indonesia, nearly half of the household food budget might be spent on street foods because street foods are fast, convenient, and cheap (Tinker, 1999). The importance of street food in the universe has been growing which can also be verified with the research done by various researchers from different countries.

In 1999, Tinker reported that only several street food trade activities and studies had been conducted in the nations of Philippines, Indonesia, Thailand, Bangladesh, Egypt, Nigeria, Senegal, India, Jamaica, and the United States. However, even up to date, only limited scientific data on the microbiological quality and safety were investigated for street vended foods in South Africa (Kubheka *et al.*, 2001; von Holy *et al.*, 2006; and Lues *et al.*, 2006), and other countries such as, Brazil, Dominican Republic, India, Malaysia, Mexico, Nigeria, Pakistan, Senegal, Slovenia, Trinidad, Zambia and Zimbabwe worldwide, and many of them were in developing countries. Summaries of these street foods related research were sorted

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by published date and listed in Table 1 as well as their investigation methods and sampling numbers.

STREET VENDORS AND STREET FOODS (PEOPLE, PLACE, AND FOOD)

Street vending is a good source of income for vendors which requiring low capital investment and lack of formal jobs for the working age groups, thus leads to their numbers continue to increase these years in many developing

countries (Lues *et al.*, 2006; and Gadaga *et al.*, 2008). Street foods are increasingly important part of the daily diet and provide a source of inexpensive, convenient and comparatively nutritious food whose familiarity and taste are also the appealing factors that make street foods popular as food sources in many countries (Hanashiro *et al.*, 2005; and Lues *et al.*, 2006).

Street foods are prepared and sold by vendors in streets and other public places which had raised researchers

Table 1: Summary of Street Vending Research and their Surveying Location, Methods of Survey and Sample Sizes

Locations (Surveying Time)	Authors and Published Years	Survey Methods	Surveyed Numbers of Vendors or Food Samples
Pakistan	Bryan, Teufel, Riaz, Roohi, Qadar and Malik (1992)	Microbiological quality (total viable counts, coliforms, <i>Bacillus cereus</i> , <i>Staphylococcus aureus</i> , <i>Clostridium perfringens</i>)	Chat (potato, graham, dough, chickpea, fermented milk, beans and fruit syrup)
Guatemala city and Antigua	Freese, Romero-Abal, Solomons and Gross (1998)	Microbiological quality	72 samples for Aerobic Plate Count (APC), coliforms, and <i>E.coli</i>
Zaria, Nigeria	Umoh <i>et al.</i> (1999)	Observation and microbiological quality	160 food samples for <i>Salmonella</i> , <i>Bacillus cereus</i> , <i>Staphylococcus strains</i>
Ga District, Ghana	King, Awumbila, Canacoo and Ofoosu-Amaah (2000)	Standard 5-point check list for service area hygiene & microbiological quality	160 chop bars
			Food and water samples
Kuala Lumpur, Malaysia	Toh <i>et al.</i> (2000)	Interviews (questionnaire of demography, food safety, practice, and attitude)	100 hawkers from 15 sites
Johannesburg, South Africa (June to Sep., 1999)	Kubheka <i>et al.</i> (2001)	Microbiological quality (APC, spore counts, gram-negative counts)	110 food samples from 16 street vendors (55 salad samples + 55 gravy samples)
		Detection of <i>B. cereus</i> & <i>C. perfringens</i>	
Manhattan, New York City (March, 2001)	Burt <i>et al.</i> (2003)	Observe vendors hygiene practices, food storage and contamination for 20 minutes	10 processing mobile food vendors
Trinidad (June 15 to July 15, 2001)	Mankee <i>et al.</i> (2003)	Bacteriological quality & questionnaires from two counties	APC, <i>E. coli</i> & <i>S. aureus</i> of 200 (140+60) "double" samples from 100 vendors
			Interviewing 150 vendors from each counties (total 300 vendors)
Dakar, Senegal (Jan. 2003-April, 2004)	Cardinale <i>et al.</i> (2005)	Questionnaire with 80 questions & microbiological checking of food samples	148 street vended restaurants

Table 1 (Cont.)

Mexico city, Mexico (May 2004)	Estrada-Garcia <i>et al.</i> (2005)	Microbiological checking of food samples	48 food samples (18 of raw oysters, 12 of fish ceviche, and 18 of shrimp cocktails)
São Paulo city, Brazil (May to June, 2001)	Hanashiro <i>et al.</i> (2005)	Microbiological quality	40 samples for coliforms, Staphylococcus aureus, Bacillus cereus
Bloemfontein, South Africa (late summer to mid-winter, March to June, 10 am-2 pm)	Lues <i>et al.</i> (2006)	Questionnaire with 5 categories	45 vendors and food samples for coliforms, <i>E.coli</i> , <i>Staphylococcus aureus</i> , <i>Salmonella</i> , yeasts, moulds
		Checklist with 5-point scale Microbiological checking of food samples	
São Paulo city, Brazil	Lucca <i>et al.</i> (2006)	Interview, questionnaires, observations	20 hotdog vendors; measurements of food's internal temp every hour, and pH value of ketchup, mustard, mayonnaise, relish and mashed potatoes
		Measurements of food's internal temperature and pH value	
New Delhi and Patiala city, India	Ghosh <i>et al.</i> (2007)	Testing for Staphylococcus aureus and Shigella spp.	150 food samples from 75 vendors
Abeokuta, Nigeria (April-Sep., 2005)	Omemu <i>et al.</i> (2008)	3-point scale questionnaire with 67 questions	87 vendors
Harare, Zimbabwe (April, 2004- March, 2005)	Gadaga <i>et al.</i> (2008)	Food samples	781 food samples testing for <i>Bacillus cereus</i> , <i>Salmonella</i> sp.,
		Water samples	240 water samples for <i>E.coli</i>
		Swab samples of hands and utensils	964 swab samples for Staphylococcus aureus and <i>E.coli</i>
Slovenia (2005)	Jevšnik, Hlebec and Raspor (2008)	Questionnaires about food safety handling, knowledge and practices of vendors	386 food handlers (respondents) from food production
Latino District of Oakland, CA, USA (Spring, 2008)	Tester <i>et al.</i> (2010)	Observation for 30 minutes	9 schools (6elementary and 3 middle schools) with 1/4 mile buffer around each school
		Observe for consumers, food items, vendor type, and total transactions	1355 food items sold to 1195 individuals
Kampala, Jinja and Masaka (August, 2008 to May, 2009)	Muyanja <i>et al.</i> (2011)	Questionnaires and checklist used in interview about hygiene practice, knowledge of diarrhea, regulation and suggestions for improvements	225 vendors
Guwahati, Assam, India (2008)	Choudhury <i>et al.</i> (2011)	Different questionnaires for owner, food service unit, type of food stuffs prepared/served, training, storage of ingredients, etc.	80 vendors, owners or food handlers
Tainan City, Taiwan (January to March, 2009)	Sun, Wang and Huang (2012)	Questionnaires for vendors about their food safety handling, knowledge and practices	120 night market food vendors

concerns about its safety (King *et al.*, 2000). Toh *et al.* (2000) had categorized street vendors by their vending environments, such as designated site, day/night market, kiosk, or by the roadside. Street food sellers were also divided into three different categories by World Health Organization (WHO) based on their methods of sales; mobile food sellers, stationary food sellers without shelter which sell food at the spot, and stationary food sellers without shelter which serve food on tables (Umoh *et al.*, 1999). Thus, street vending can be stands or stalls that located stationary at designated site or roadside without shelter, or mobile without designated locations with various day or time and length of selling hours.

Types of street food preparation can be ready-to-eat, cooked on site or none (raw) items (WHO, 1996). The food items sold by street vendors can be home-made products or modern factory-processed ready products (Ekanem, 1998), and even factory-half-processed foods or raw ingredients then cooked or prepared at the selling sites. That meant vendors can purchase raw materials from retailers to prepare their meals fresh everyday or buy industrially processed foods and usually sold within 6 hours; either display only, prepared in advance or on demand (Hanashiro *et al.*, 2005; and von Holy *et al.*, 2006). The stationary food sellers can start cooking operation as early as about 6 am and sell between 9 am to 7 pm (Umoh *et al.*, 1999) or even later. With this possible long hours of food preparation, safe handling of food is very important.

Food can also be divided into high risk and low risk foods according to their potential hazards that depending on the ingredients and handling methods used. High risk foods usually are foods with an animal origin, high protein content, high moisture content, relatively high pH (above 4.5) or a relatively large number of ingredients; and low risk foods are foods heated properly and/or kept at a safe temperature (above 54.5 °C) or foods with low moisture contents (Freese *et al.*, 1998). WHO (1996) had categorized food types of street vending as grain and cereal, fruit and vegetable, meat and fish, frozen produce, and beverage; while Ekanem (1998) also categorized street foods into meat, fish, fruits, vegetables, grains, cereals, frozen products and beverages. Snacks may also be prepared and served separately in the streets, including dried meat, fish, and cereal based ready-to-eat food (Gadaga *et al.*, 2008).

REPORTED SAFETY PROBLEMS OF STREET FOODS

The sale of street foods in public places is highly controversial from a health standpoint which may pose a public health problem due to the ignorance of most food handlers who may be lack of basic food safety and good food handling knowledge as well as improper hygienic techniques that fail to ensure food safety and are threats to consumer health (Ekanem, 1998; Toh *et al.*, 2000; and Lucca *et al.*, 2006). Increasingly more people are turning to informal food vending as a source of livelihood in Harare of Zimbabwe was reported (Gadaga *et al.*, 2008) and it is a worldwide phenomenon which results in increasing concerns among health officers about the safety of street foods.

Foodborne Illness and Their Vehicles

It was reported that where street vending foods are common, there are usually epidemiological data on the incidences of foodborne disease or outbreaks (Ekanem, 1998). Street foods prepared and sold by vendors in streets and other public places, particularly in developing countries have implicated for the spread of zoonoses or can be contaminated by pathogens because they are sold in the open and may not be covered during display (King *et al.*, 2000; Mankee *et al.*, 2003; and Ghosh *et al.*, 2007). Besides, their selling locations usually do not meet food safety and hygiene requirements where waste and garbage may accumulate, providing and attracting insects and animal in the surroundings (Gadaga *et al.*, 2008).

The health risks posed by street foods in various countries are frequently reported mainly due to poor sanitary practices during preparation and sale such as poor local infrastructure, trading features, and the lack of sanitary surveillance along with the characteristics of the products sold which increase concerns about the potential for possible microbiological contaminations food poisoning in street food safety (Mankee *et al.*, 2003; Hanashiro *et al.*, 2005; and Omemu *et al.*, 2008). The presence of pathogens and high microbial loads in some street foods have shown epidemiological links with food-borne illness which might due to the results that highly crowded markets usually had difficulties in meeting good hygienic standards (Umoh *et al.*, 1999; and Gadaga *et al.*, 2008). Multiple routes of entry, high ambient temperature, contact surface, and bare hands have also been implicated as important sources of cross-contamination of entero-pathogens in street foods (Ghosh *et al.*, 2007).

Foodborne bacterial pathogens commonly found in street food studies include *Bacillus cereus*, *Clostridium perfringens*, *Salmonella* spp. and *Staphylococcus aureus* which have been implicated in several outbreaks of foodborne diseases with *Staphylococcus aureus* has remained as a global level of significance in food due to its wide-spreading in the environments (Mosupye and von Holy, 2000; Kubheka *et al.*, 2001; and Ghosh *et al.*, 2007).

Raw materials for street vended food are generally improperly stored in unsafe temperatures for a long period of time which are often undesirable with foods like poultry, pork, beef, fish, and rice, sold in the street; and are frequently identified as vehicles of disease transmission (Ekanem, 1998).

Related Research Results

It was reported that most handlers of street food vending in Africa and other the developing world usually were ignorant of basic food safety issue and were often unlicensed, untrained in food hygiene and sanitation and worked under crude unsanitary conditions selling both raw and uncooked un-regulated food items and operated without any monitoring of the foods they sold (Ekanem, 1998; and Omemu *et al.*, 2008). Research also showed vendors' hands of street stalls at Harare, Zimbabwe were un-acceptably contaminated which indicating poor hygienic practices (Gadaga *et al.*, 2008).

For the microbiological hazards of street food, Mosupye *et al.* (2000) found in their research that bacteria counts of raw materials were significantly higher than those of corresponding cooked foods, but no significant differences in all count types were observed between food samples collected during cooking and those collected during holding. Kubheka *et al.* (2001) concluded in their research and declared that lack of hygiene was not a major determinant of the quality and safety of ready-to-eat street vended salad and gravy at Johannesburg, South Africa; they suggested that the key was to reduce the growth of the bacterial populations with short holding times of the prepared foods. The research done by Hanashiro *et al.* (2005) showed no difference was found between the microbial counts of home- and street-made samples. Although studies have shown that foods prepared on the street can be safe, there is still needs to monitor the safety of street food to ensure the protection of the consumers (Gadaga *et al.*, 2008).

Several researches had been done on street vended foods with surveys of food safety knowledge of vendors and observation on hygiene practice during selling. King

et al. (2000) had used a standard 5-point check list for checking the infrastructures at service areas; Toh *et al.* (2000) had interviewed vendors with questionnaires for their demography, food safety, practice, and attitude; Mankee *et al.* (2003) had surveyed both vendors and consumers about their attitudes, knowledge and perceptions of food and health risks. Lues *et al.* (2006) had constructed a structured questionnaire and a checklist covering various aspects relating food safety knowledge and practices among street vendors with five categories consisting, i.e., demographic data, cooking and preparation practices, personal hygiene practices and health, storage practices, and sources and suppliers of food. Lucca *et al.* (2006) had used interviews, questionnaires, and observation for food handlers and storage conditions. Omemu *et al.* (2008) had used 3-point scale questionnaire with 67 questions and survey 87 vendors about their hygiene condition while selling street foods. Jevšnik *et al.* (2008) had investigated hot-dog vendors with questionnaire about food safety handling and hygiene knowledge and practices.

Inappropriate hawker locations, vending stalls located outdoors with or without roof cover, or situated at high traffic areas will make street foods more susceptible to contaminations. Other problems with vending foods are the preparation and the selling of food besides limited infrastructures or poorly-designed stalls which inadequate basic amenities like restricted access to drinking water, hand and dishwashing water or potable running water, toilets, and waste disposal facilities. Water is usually insufficient and often reused, waste water may be discarded in the street and garbage disposed around. Lack of refrigeration facilities (refrigeration units or ice), lack of personal hygiene, improper handling practices, lack of training and display food for a long period of time, especially in the warm areas or seasons, pose health risks for street vended foods were reported by most studies along with poor management, lack of enforcement, and no formal education of hawkers (Toh *et al.*, 2000; Lucca *et al.*, 2006; and Lues *et al.*, 2006).

Questionnaires were used as the principal measure of food handling knowledge and the general topics may cover high-risk foods, foodborne illness, temperature control and cleaning (Egan *et al.*, 2007). Microbiological testing of street food had showed varied results; thus, surveys with interviews, questionnaires, and observation will be proper methods for realizing and investigating the hygiene practice and safety knowledge of food handlers. Possible handling practices of street vended foods with sources of

contamination and their variables or indicators of concerns from all researchers about street vending were sorted and listed on Table 2. Possible survey questions for personal hygiene, food safety knowledge and practice were listed on Table 3. Table 4 listed food handling situation during various health problems (food handling and health problem) and Table 5 were the basic demography information for vendors; such as age, sex, years of working, etc.

Vending Structures and Environments

Street vendors can be divided into three types by the locations of their facilities. Type of vending facility can be mobile carts, fixed stalls, or in improved food centers (WHO, 1996). Stands and carts can be in crude and inefficient condition and food products were often exposed to sources of contamination like soil, dust, and sand (Ekanem, 1998). High environmental temperature and relative humidity during the selling time were ideal for the multiplication of bacteria which may conceal other safety problems (Umoh *et al.*, 1999). Vendors only had limited access to basic sanitary facilities such as running water, garbage disposal and clean toilets which might introduce more chances for cross-contaminations with dirty hands (Kubheka *et al.*, 2001).

There are needs for improving infrastructure and sanitation facilities of vending sites and Lues *et al.* (2006) had reported that the conditions of the vending site structures in South Africa with 38% as “poor” (no form of structure), 60% as “fair” (with some kind of informal structure) and only 2% as “good” (with permanent or semi-permanent structure). Vending sites are not designated for good vending and do not provide the necessary infrastructures and facilities for food handling operations will result in high levels of cross-contamination which indicates that vendors need continuously training and sensitization on the need to operate good hygienic practices and to store their raw materials correctly (Gadaga *et al.*, 2008).

Preparation and Storage

Raw materials or processed foods that are sold on the street should be from legal and safe sources to ensure the safe of foods, and should be stored properly according to the nature of the foods used before use by date. Street foods are usually prepared or semi-prepared (thawing, washing, cutting, or cooking) at home due to the lack of space and water at the vending sites. With the various types of foods may sell on the street, the preparation and storage methods vary a lot. Some foods need a lot of attentions (if high risk foods) and

preparation before actual selling and displaying. If foods are prepared or semi-prepared before selling, adequate cooking should be performed; with the raising of foods' internal temperatures, heated foods need to be cooled down properly (lowering of certain temperature at certain time) and after that stored properly before selling to ensure food safety. Temperature maintaining of covered foods transport from home to vending site and before cooking or serving is another key point for food safety.

Time-temperature abusing of food, unsafe storing temperature, serving food cold or without sufficient reheating were the problems with vended foods in Africa (Ekanem, 1998). Lues *et al.* (2006) declared that practices such as preparing food at home should be discouraged since the majority of the street vending foods was prepared on the previous day without adequate refrigeration before selling or serving; long storage time at unsuitable temperature may result in higher hazards of food safety problems. Cold storage and keep food in a safe condition while in displaying are important for food safety, only a few vended food samples and ingredients were kept in thermal boxes or in mobile carts, and most of them were kept at ambient temperature for actual street vending practices. Refrigerators and ice involve high maintenance costs and are thus used almost exclusively for beverages (Hanashiro *et al.*, 2005) instead of maintaining food in safe temperature before serving.

Display and Serving

Most traditional street foods are presented and delivered in the open, without proper protective packaging (Ekanem, 1998) which means flies, insects and dusts might have chances for contamination. Another possible contaminating source may be lack of thorough cleaning of cooking utensils which result in cross-contamination to ready-to-eat foods (von Holy *et al.*, 2006). During displaying of street foods, avoiding long holding time at improper temperature, covering of food to prevent insects and dusts, and frequent cleaning of utensils are the correct practices for street foods.

Long holding hours of food for more than 4-6 hours was one of the main contributing factors of food contamination; holding temperature below 54.5 °C can also lead to growth of pathogens, and without reheating the food sufficiently, high microbial loads can be detected in foods (Freese *et al.*, 1998). Most of vended foods were generally prepared in bulk and displayed for more than 6 hours or a whole day for sale at ambient temperature with or without re-warming or

Table 2: Aspects of Handling Practices for Street Vended Foods (Sources of Contamination and their Variables or Indicators)

Practices	Sources	Concerns	Problems, Indicators or Possible Measurements
Ingredients	Food sources	Origin	Unsafe source, contaminated; Presence of toxic materials
	(Raw materials)		Purchase raw materials of dubious quality in order to keep prices low
	Transport	Refrigeration	Food storage condition (temperature, cleanliness, place)
	Storage	Use by date	Presence of cleaning products away from food
Preparation	Preparation site	Handling of ingredients	Place and conditions for preparation
	Handling practices	Pre-treatments of raw material	Uncover
			Thawing methods
			Cleaning or peeling; Thorough washing of food to be cooked
			Cutting and chopping (Wooden table, stainless steel table, bucket or bowl)
			Time and temp during preparation, allow bacteria growth
		Cooking procedures	Food cooked in large pots
		Temperature and time during cooking	Adequate cooking of food (inadequate cooking)
		Time between preparation and sale	Lapse of 12 or more hours between preparing and serving
			Cooked during sale, cooked during morning of sale
		Frying oil change frequency	Inadequate cooling
		Frying oil change time	Daily, weekly, monthly, never change (top up), do not use cooking oil
		Frying oil change time	Vigorously foaming, when food in oil because unpalatable, when oil darkens, darken the food, when oil is not good, oil used up during cooking, do not use cooking oil
		Time taken to transport to sale place	Preparation too far in advance left at room temperature, or extra large quantities prepared improper warm holding
Hot holding, or re-heating before sale			
Cross-contamination	Contamination of raw food, Infected handler, inadequate cleaning of equipment, contaminated water		

Table 2 (Cont.)

Food group	Hot food or cold food	Not sufficient heating	Cooking or reheating on site
		Contamination	Hot: heating
		Serving temperature	Cold: ice source
			Non-reheated: time and temperature
Risk levels of foods	Kind of food mainly served (high protein or moisture)	Poultry, meal, soup, seafood, deep-fried foods, grilled	
		Red meat, chicken, salad, gravy, vegetable	
Selling of food	Displaying place, time, and methods	Long holding time	Bacteria growth
		Places tend to be contaminated	Displayed food next to a drain/toilet, refused dump, or in pathway
		Ready-to-eat food uncovered	Sold from tray with covering or without covering; Dust contamination
		Methods for cooked food storage	Refrigerator, food warmer, charcoal stove, plastic container, clay pot, baskets, polyethene bags
	Utensils used in cooking, mixing and serving	Use of different utensils for each task	No in-between cleaning (Cross-contamination); (Knife status: clean, dirty)
		Contamination	With fork/spoon, with bare hands; into cup/plate, into paper/leaves
			Mixing utensil for raw and cooked foods (used in several tasks)
	Serving	Food carriers	On plates/cups, paper bags, plastic bags, newspapers/recycled stationary
		Use of remaining condiments	Used to feed family at home, poured away, no refused food condiments, eaten by the workers, recycled
	Leftover	Destination of leftover	Left overnight at ambient temperature Refrigeration or not
Cleaning	Utensil	Cleaning methods	Soap and water, hot water, drying with cloth; rinsed with cold water, rinsed with cold water and soap, rinsed with hot water, rinsed with hot water and soap, no plates or cups used
	Dishes	Dishwashing physical facilities	Appearance, sufficient number, hygiene condition, washing frequency
	Dish cloth	(Equipment)	In one bucket, or pan; Improper cleaning
		Disinfection (Disinfectant not used)	

Table 2 (Cont.)

Water supply	Source, aspect	Source of water	Public toilet, home, on site tap (pipe-borne), taken from home and stored in containers, deep well, streams; protected well, vended water (water sold in containers), tap water, water tank (rain water)
		Availability of water at point of sale (nearest water source from vending site)	No running water at vending site; Accessing to clean running water. On site, less than 5 minutes walk, 5-15 minutes walk, more than 15 minutes walk
		Water storage conditions	Hygiene condition of the storage container
		Use of safe water	For washing hands, preparing foods (cooking, drinking) and cleaning utensils
		Frequency of changing raising water	Once a day, twice a day, when dirty, sink has drainage
Wastes	Garbage	Cover	Yes, without cover (open litter bin)
		Tool for waste disposal	Garbage bin, plastic bag, outside (discard on street),
		Contacting with food being served	Yes, no
		Frequency of waste disposal	Several times a day, once a day, less than once a day
	Garbage bin	Numbers	One, two, three, none
		Type	Left on site on the ground, gunny bags, plastic bucket, paper box
	Waste water	Contamination	Discard on street, stagnant water (on ground)
	Final garbage disposal	Type	Landfill, roadside on bear ground, municipal council container
Distance		Less than 10 m, 10-100 m, 100-200 m, more than 200 m	
Surrounding area	Vending site	Type	Open air, shell construction, stall Proper ventilation and lighting; moist surfaces (floor/walls); dusting ground
		Suggestions	More sanitary facilities, build vending site
		Type	Pour/flash toilet, VIP latrines, pit latrine, no toilet facility
	Toilet facilities	Condition	Wet floor, dis-functioning flush system, toilet out of use, big ratio of users to latrine, visible dirty toilet Hand washing facility with water and soap, hand washing facility with water
		Animal on site	Food are not protected from dust and flies Air pollution, insects, rodents, other animals; Exposed to flies
	Pathogens, zoonese	Microbiological testing	Foodborne illness

Table 3: Summary of Survey Questions for Personal Hygiene and Food Safety Knowledge in Vending Practices

Related Areas	Food Safety Knowledge	Food Safety Practice (or possible surveying questions)
Vending establishments	Vending site cleanliness	Poor, fair, good
	Licensed unit	Yes, no
	Seating capacity	Nil, up to 3 persons, up to 5 persons, above 5 persons
	Age of the unit	Below 5 years, 5-10 years, 10-15 years, above 15 years,
	Mode of lighting	Gas light, candle, not applicable, electricity
	Covering of the unit	Permanent cover, covered with tent, remains open
	Average number of consumers	Below 30, 30-60, 60-90, above 90
Cooling unit (refrigerator)	Food storage position	Higher, middle, or lower rack
	Microorganisms in cooling unit	Grow very slow, grow quite fast, grow very fast, do not grow, all die, I don't know
Delivery of raw materials	Fruit and vegetable were delivered	Check hygiene condition of the delivery vehicle, check the temp of the fruit and crops, check the quality of fruit and crops, check driver's personal hygiene principles, check consideration of good agriculture practice requirements
Thermally processed food	Temp for maintaining food warm	(37 °C, 53 °C, 63 °C, or 83 °C)
	Measuring internal temperature (importance)	Not important, important
	Wrong temperature value	Do nothing, correction, call maintenance, ask manager, ask co-worker
Food safe to eat	Presence of pathogens	Smell bad, sour taste, moldy food, can not be told by appearance
	Definition of hygiene	Satisfactory, unsatisfactory
After cutting (meat)	Used knife cleaning	Wipe with a kitchen cloth, wash and disinfect occasionally, wash with boiling water, wash under running water, wipe with a paper towel
Personal hygiene (Personal cleanliness)	Clean presentation	Presence of clean hands; hand and arm jewelry; bath regularly
		Presentation, bodily cleanliness, clean hands and nails
	Appearance	Cap, apron, clean clothes, glove, (hair net, glove, apron)
	Work clothing	Specific clothing, cleanliness; aprons
		Use of closed shoes and overalls
	Hair	Use of hat, hair net or head ties; Hair short or tied; hair covered
	Glove worn	Yes, no
	Hands	Finger nails cut, finger nails clean; clean hands
	Hand wash	Frequency; Place and occasion on which hands were washed,
		Wash hands after different activities, coughing, sneezing over food and the appropriate use of disposable gloves
		Hands washed at least 3 times daily, hands washed more than 3 times daily
		Hands not washed throughout the day
	Times for washing hands	Yes, sometimes, no
		After visiting the toilet, after sneezing, coughing, smoking, touching money, handling garbage; During continuously food handling, after eating meals, handling raw foods, scratching
	Means of hand washing	Water, water and soap; Clean water, soap,
Hand drying	Nothing, disposable paper towel, towel or cloth (clean hand towel)	
Hand disinfection	Disinfection solution	
Serving practices	Touching money during serving	
	Allow buyers to use bare hands	
	Speak while serving the food	
	Use hands to exchange money	

Table 3 (Cont.)

Vendors safety knowledge	Know what's foodborne illness	Illness caused by food source
	Symptoms of foodborne illness	Stomach pain, diarrhea, vomiting, nausea, headache
	Type of foodborne illness	Typhoid: from contaminated water or food
		Cholera: from contaminated water or food
		Dysentery: from contaminated water and food
	Type of food contaminants include	Worms and parasites; splinters of wood and shards of glass; invisible germs in foods; kerosene oil, detergent, or similar products; food coloring, flavoring and spice; insects, insect droppings and dirt
	Sources of contamination by pathogens	Contamination of raw food, infected handler, inadequate cleaning of equipment, unsafe source, contaminated water
	Growth of pathogens	Preparation too far in advance, left at room temp, foods cooked in large pots, improper warm holding, extra large quantities prepared
	Survival of pathogens	Inadequate cooking or reheating
	Ways to control food contamination	Food cooked on the premises, food cooked well in advance of consumption, food cooked on morning of sale, cooked food sold from cooking sauce pan, food kept on cooking fire during sale, food sold from tray with covering, food reheated before sale
	Faults that increase food contamination	Food handled at ground level, food exposed to flies, food sold from tray with no covering, cooked food scoop into containers
	Knowledge of related food and pathogens	High risk foods, foodborne pathogens
Practice	HACCP; Food regulation and control	
State of personal health	Handling implicated food	Colonized person; Presence of respiratory infection and skin disease
	Preparation food when ill	Yes, no
Enforcement of hygiene regulations	Regulated authorities	Governments, on-site management, no regulations
	Enforced regulations	Ensure sanitation, none

Table 4: Questions for Proper Food Handling and Health Problem

Food Handling	Questions for Food Handling Situations	
May vendor handle food when	Having a diarrhea?	I am upset?
	Having a hypertension?	Having wounds on my hands?
	Having a cold?	Having a fever?
	Having a toothache?	Having nausea?
	Coughing and wearing a protection mask?	Having sore eyes?
	Having a raised temp?	Having stomach cramps?
	Vomiting?	Having sick member of family?
	I had cut myself?	Having a catarrh?
	Wearing nail polish?	
Does vendor wash hands	After visiting the toilet?	During continuously food handling?
	After sneezing, coughing?	Handling raw foods?
	Smoking?	Scratching?
	Touching money?	After eating meals?
	Handling garbage?	

Table 4 (Cont.)

Definition of diarrhea	Passing more than 3 liquid stools a day	Passing of mucoid stools
	Passing of bloody stool	Don't know
Cause of diarrhea	Germ	Don't know
Transmission of foodborne pathogens	Dirty water	Dirty hands
	Dirty food	From animals
	All above	Don't know

Table 5: General Demography and Socio-Economic Information of Vending Personnel

Parameters	Related Information and Survey Questions
Age	(20,40, >40), (<30, >30), (19-29, 30-40,41-50,51-65), (<20,21-30,31-40,>40), (<25, 25-50, >50)
Gender	Female, male
Marital status	Married, single, widowed
Ethnicity; language	Malay, Chinese, Indian, others
Education level (Educational attainment)	No formal education, primary school, lower secondary (junior high), upper secondary (senior high)
	No school, primary school, secondary school, tertiary/vocational school; Grade 1-8,9-12
	Illiterate, Up to primary, Primary to High School(HS), HS to graduate, Above graduate
Ownership	vendor, owner, employed
Main occupation	Yes, no
Place to which you belong	Local, migrated
Length of time spent vending (year);	<5, 6-10, 11-20, >20
Duration of engagement in this occupation	
Average monthly income	<500, 500-1000, 1000-1500, >1500 (India)
Vending mobility (type of facility) (type of vendors)	Mobile carts, fixed stalls, improved food centers (mobile, stationary)
Type of infrastructure	Potable water, toilet (flush toilet or other), hand wash facilities, dish/utensil washing, refrigeration available, waste disposal
Food type of sale (type of food)	Grain & cereal, fruit & vegetables, meat and fish, frozen products, beverages;
	Processed, main meals, soups and stews, snacks
Type of preparation	Ready to eat, cooked on site, none (raw);
	Home made, home-street made, street made (Home, both, stall)
No. of people working at a stall;	Only one person, two food handlers, three food handlers; Employment status
Employees engaged in this unit	Nil, up to 3, up to 5, above 5
Any employee below 16 years	Yes, no
Jobs done by family members	Supervision & cash holding, purchases, cooking, serving, cleaning

Table 5 (Cont.)

Acquisition of knowledge of food preparation	Through observation, formal training, others
Knowledge about food	Source of information on health risk after consumption, or reason for not eat
Hygiene knowledge and training	Pre- and post-training tests of knowledge; Information on health risk
License and certificate	With or without periodical medical exam (health certificate)
	Valid chef related license
Note: References sorted from (WHO, 1996; Mosupye <i>et al.</i> , 2000; Toh <i>et al.</i> , 2000; Mankee <i>et al.</i> , 2003; Hanashiro <i>et al.</i> , 2005; Lues <i>et al.</i> , 2006; Omemu <i>et al.</i> , 2008; and Choudhury <i>et al.</i> , 2011).	

Table 6: Observation Checklist for Food Vendor Operations

Survey location: _____ Seats provided: yes no
 Food types: snacks staples drinks fruits bakery
 _____ (please write down the food contents)

Vendors' personal hygiene

1. Appearance of food handlers

a. Wearing gloves yes no

b. Wearing mask yes no

c. Hair covered (hairnet or cap) yes no

d. Wearing apron or uniform yes no

e. Clean outfit clothes yes no

2. Handling food in 15 minutes

a. Changing gloves yes no

b. Washing hands yes no

c. Sneezing yes no

d. Coughing yes no

e. Spitting yes no

f. Smoking yes no

g. Drinking yes no

h. Chewing betel nuts yes no

i. Touching money (check if wearing gloves) yes no

j. Touching face, body, or hair by hand yes no

k. Wearing accessories (watch, ring, polished fingernail) yes no

Food preparation (circle which applicable)

1. Food storage

a. refrigerated ice bucket no cooling treatment

b. with cover without cover

2. Cooking methods

boiled deep fried steamed

pan-fried roasted or BBQ

no treatment (no further heating treatment)

Table 6 (Cont.)

3. Food displaying	a. <input type="checkbox"/> room temperature	<input type="checkbox"/> cold	<input type="checkbox"/> hot
	b. <input type="checkbox"/> cooked food and keep warming		
	<input type="checkbox"/> cooked food, heated again when sold		
	<input type="checkbox"/> cooked food, no more heating again when sold		
	<input type="checkbox"/> raw food, heated when sold		
	<input type="checkbox"/> raw foodc		
	<input type="checkbox"/> with cover		
	<input type="checkbox"/> without cover		
Selling behavior (circle which applicable)			
1. Tableware	a. <input type="checkbox"/> plates or cups	<input type="checkbox"/> wash needed	
	<input type="checkbox"/> no need to wash (disposable plates/cups, paper bags or plastic bags)		
	b. <input type="checkbox"/> utensils (fork, spoon, knife)		
	<input type="checkbox"/> wash needed		
	<input type="checkbox"/> no need to wash (disposable)		
2. Wiper	<input type="checkbox"/> clothes (<input type="checkbox"/> clean <input type="checkbox"/> dirty)		
	<input type="checkbox"/> paper towel		
Washing and disposal handling			
1. Garbage covering	a. <input type="checkbox"/> yes	<input type="checkbox"/> no	
	b. <input type="checkbox"/> trash bag	<input type="checkbox"/> trash can	<input type="checkbox"/> no containers at site
2. Discarded water	<input type="checkbox"/> pour on site	<input type="checkbox"/> pour at other place	<input type="checkbox"/> unknown
3. Plates/cups cleaning	<input type="checkbox"/> wash at vending site	<input type="checkbox"/> wash at other location	<input type="checkbox"/> no need to wash
4. Distance from water source	_____ meters away		

re-heated before serving; while cooked food might be touched by sellers or buyers during service (Umoh *et al.*, 1999) which are also possible sources for contamination. Street foods should be kept either at refrigerated temperature or on ice, and cover while in the stalls (Estrada-Garcia *et al.*, 2005) before selling or serving.

Other problems with food were that reheating temperature did not reach 74 °C and the time for complete consumption was in excess of 5 hours (Lucca *et al.*, 2006) during selling. Sometimes, reheating is performed only for fast warming the foods before serving and is particularly critical for home-made foods which are probably already held at ambient temperature overnight (Hanashiro *et al.*, 2005). As vendors try to supply their clients as quickly as possible (Gadaga *et al.*, 2008) during practice, inadequate cooking might occur and cause safety problem for vended foods.

Lucca *et al.* (2006) found that the main problems of hot-dog stands at São Paulo, Brazil were poor hygienic condition of equipment and utensils with problems like utensil was left uncovered, ingredients stored in unsuitable containers, dispensers (ketchup and mustard sauce) maintained at room temperature, trash cans left open and in unsuitable places and the presence of animals and insects.

Leftover Foods

Problems with leftover foods are that after long hours of displaying, foods may be high in bacteria loads and are easier to be spoiled or with high numbers of pathogens which may cause lose of merchandise; or without proper reheating, cause foodborne illness after consumption. Umoh *et al.* (1999) reported that the vending practice of Nigeria with leftover foods were generally taken home at the end of

the day, reheated and stored at ambient temperature until the following day when it could be re-heated and displayed again. von Holy *et al.* (2006) declared that leftover foods at South Africa would either be given to the homeless on the street or taken home for consumption by the family; very few vendors would re-sell leftovers and those that did produced food that was microbiologically less acceptable. Leftover food should be discarded and/or properly stored at refrigerated temperature after re-heated if necessary. Storage methods should follow proper handling procedures with shallow containers for quick temperature lowering.

Waste and Disposal

Waste water usually discarded in the street and garbage discarded near the food stand in Africa; and trash cans left open and animals (insects) around in Brazil were reported for actual street vending practices by researchers (Ekanem, 1998; and Lucca *et al.*, 2006). Appropriate waste disposals are needed for street vending (Estrada-Garcia, 1997) but rare waste disposal system or equipment are carried out for actual vending practice.

Wastes should be discarded in garbage bins or plastic bags with covers instead of left opened or discarding outside on street or roadsides to avoid insects and strayed animals. Waste disposal frequency should be done several times a day if necessary and avoiding contacting food being served or with bare hands.

Personal Hygiene Practice

Availabilities of proper portable water or running water have been reported (Estrada-Garcia, 1997; and Ekanem, 1998) for street vending which has always been a major problem for maintaining personal hygiene in practice. At the report by Lues *et al.* (2006) still declared that street vendors had limited access to potable tap water at the vending site and had various ways of obtaining their water sources; either from nearby public toilet, on site taps, nearby shops and building or bringing the water with them from home.

Toilet facilities are seldom readily available in Africa (Ekanem, 1998); handwash frequency was extremely low in all points-of-sale at Brazil at the study done by Lucca *et al.* (2006). Most of the vendors wash their hands after visiting a toilet and only 4% (2 persons) washed their hands with soap and water, while the rest only use water in South Africa (Lues *et al.*, 2006). Hand, dish, and utensil washing may be done in one or more buckets or pans, and sometimes without soap due to lack of potable running water beside the vending

stalls and disinfections of hands, dishes, utensils are rarely carried out in Africa (Ekanem, 1998).

Cardinale *et al.* (2005) had found that dirty clothing of staff elevated the risk of food contamination in Senegal. About 71% of the vendors covering their hair during food preparation and none of the vendors wearing gloves during investigation under the study at South Africa done by Lues *et al.* (2006) which indicated that hand washing should probably be the most important part of their daily routine.

There are also differences between vendors' food safety knowledge and practice since it was reported that vendors' self-reported behaviors and observed or actual behaviors have discrepancy (Egan *et al.*, 2007). Rheinländer *et al.* (2008) said that future public health interventions within the street food sector should give emphasis to the importance of appearances and neatness when designing communication strategies and emphasize on food safety, such as good hand hygiene and cleanliness of kitchen facilities with the help from local vendor networks which can be an effective point of entry for future food hygiene promotion initiatives.

EDUCATION AND TRAINING FOR VENDORS

Education programs on food safety are directed at consumers, food handlers, and street-vendors, and the regulation of street-vended foods, are essential steps to halt secondary and sustained transmission of foodborne illness (Estrada-Garcia, 1997).

Ekanem (1998) said in his report about the public health hazard and socio-ecological problems posed by street food industry in Africa and emphasized the education needs of street food vendors and consumers about basic food safety matters and formulate the codes of practice for street foods using HACCP approach. Umoh *et al.* (1999) suggested that there is a need to reduce the problem of street food contamination and growth of microorganisms through proper hygiene and food preparation education of the street food sellers and the public on the importance of environmental sanitation and safe practice in the holding and cooked foods. Toh *et al.* (2000) reported that differences in knowledge of the ethnic groups (Malay, Chinese, Indian, etc.) were found mainly due to the differences in their education levels about food cross-contamination, equipment, utensils and premises, personal hygiene, Hazard Analysis Critical Control Point (HACCP) and food regulations and control.

The way foods are prepared can be influenced by customs, beliefs and perceptions of the consumers and sources of training (Mankee *et al.*, 2003). The knowledge and attitudes of hawkers towards food safety as well as possible foodborne illness and their preventions were investigated in Malaysia and researchers concluded that education influenced knowledge and attitudes scores of the interviewees which meant that better educational background had shown better knowledge and got better scores in food hygiene, thus showed the importance of education (Toh *et al.*, 2000).

Training is a planned process to modify attitude or skill behavior through learning experience to achieve effective performance in an activity or range of activities (Egan *et al.*, 2007) and the training of vendors and food handlers by education would be one of the most effective interventions to reach a safer street food (Hanashiro *et al.*, 2005). However, research still shown lack of training in hygiene, rather than negligence in taking hygiene precaution, was the main reason for low adequate food hygiene knowledge (Lucca *et al.*, 2006). Most vendors had still shown inadequate knowledge of food handling practices and lack of formal educations or relatively low levels of educations (Lues *et al.*, 2006) while operating under unhygienic conditions and are still lack of basic food safety training (Ghosh *et al.*, 2007) in street vending practices.

Most food hygiene training courses rely on heavily on the provision of information (Egan *et al.*, 2007). However, recent research still reported that the education of vendors in safe food handling is not sufficient in Ghana (Rheinländer *et al.*, 2008). To be effective, food hygiene training needs to target changing those behaviors of street vendors most likely to result in foodborne illness (Egan *et al.*, 2007).

Evaluation of training is essential as well as the training content and design which can make sure the effectiveness of this activity although the evidence is still limited (Egan *et al.*, 2007). Ghosh *et al.* (2007) declared that the possibilities of foodborne diseases spreading through street foods to both local population and tourists can not be ignored, and it was suggested that change in behavior toward less food handling practice, such as reduction in holding time and periodic reheating of food, and educational activities to inform concerned people for improving knowledge about food safety practices in street vendors to ensure food safety should be encouraged (Umoh *et al.*, 1999; and Egan *et al.*, 2007).

Retraining or refresher training have been recommended and have been suggested that enough time of training and better training at workplace to make the training effective; trainings were often conducted away from the work place and may be difficult to translating theory into improved food handling which suggested hygiene training better conducting at workplace with sufficient training hours will show better improvements in food safety (Egan *et al.*, 2007). Further research is needed on issues including course content, the site of training, duration of courses and refresher training with good baseline data to achieve worthwhile results (Egan *et al.*, 2007). Certification and licensing can be means for identifying proper trained street vendors and encourage consumers to consider safety matters in their choice of what and where to buy (Ekanem, 1998).

LAW AND REGULATIONS FOR STREET VENDING BUSINESS

Legislation stipulates that when a food handler suffers from diseases such as diarrhea, sore throat, fever, cold or open skin lesions, he/she should report the condition to the supervisor or the manager (Lues *et al.*, 2006); however, most street vendors own their business individually and are the key persons in food handling so the reporting of illness is not relevant. Legislation also stipulates that wash-basins shall at all times be provided, together with adequate supplies of soap and disposable paper towels or hand drying facilities (Lues *et al.*, 2006) for food handlers; the real life situation is that water is usually short at vending sites, and local authorities have difficulty in controlling the large numbers street vending operations because of the diversity, mobility and their temporary nature of street vending food business (Lues *et al.*, 2006).

Safety Programs and Guidelines

The problem with street food is a worldwide concern and only has a few countries have specific regulation to the trade (Hanashiro *et al.*, 2005). For the required regulation, appropriate regulatory agencies should take immediate steps to elaborate their national standards on codes of practice for street foods.

Estrada-Garcia (1997) reported that food safety programs and special guidelines for street-vended food should be developed and always be included in national strategies for the prevention and control of foodborne illness such as cholera in this food industry; efforts should concentrate on appropriate regulation implementing of food-safety

programs for street-food vendors. It was also suggested that there is a need to enforce regulations on sanitary practice during and sale of food, coupled with the education of the public which should make the product safer for consumption in the population (Mankee *et al.*, 2003). Developing and enforcing adequate sanitary standards for street-food sales, offering training courses to street-food vendors, establishing a system of surveillance and epidemiological information on diseases transmitted by street-food, and applying the HACCP system to prevent contamination were recommended while regulations and licenses are needed for street food industry were also suggested (Lucca *et al.*, 2006).

HACCP system in food production has been applied and enforced in some nations and had been recommended to ensure food safety and could be applied at all stages in the food chain of street vending (Lucca *et al.*, 2006) and vended food needs to be constantly monitored (Gadaga *et al.*, 2008) which means implementing of HACCP will be the best solution to ensure food safety. Ghosh *et al.* (2007) also emphasized that government agencies must enforce regulations on sanitary practices during the preparation and selling of the street foods such as licensing, training and education.

Ekanem (1998) had reported that only very limited vendors were aware of the health risks associated with street foods; therefore, proper training of street vendors by using HACCP approach which emphasizes monitoring of critical control points could be the most important strategy for improving the safety of street foods. HACCP system has been proposed to street food trade but the reality is that there is still needs for locals to go through a culture change for both the vendors and the sanitary surveillance system to accomplish this goal (Hanashiro *et al.*, 2005).

It was recommended that vendors should be categorized by the kind of food they sell and by their mobility in order to make the regulation of this commerce more appropriate to the real risks; which should be more useful in the application of control measures (Hanashiro *et al.*, 2005). Besides, to improve street food vending, baseline research needs to be conducted to determine the safety and socio-economic importance of street-vended foods (von Holy *et al.*, 2006). Studies and information gathered from street food vendors can be used by the health officers in the development of strategic plans towards regulating safe street food handling, preparation and vending (Omemu *et al.*, 2008).

With the popularity of global traveling, more and more local cuisines and delicacies are appreciated by foreign tourists with street foods being one of the major sources of obtaining local cuisines. The standards of hygiene (the establishment of code of practice, training on hygiene and sanitation, health considerations, communication gaps, and the limited knowledge of tourists concerning the local cuisines will affect the tourism business which has been considered as an important part and need to be resolved in several countries (Cohen *et al.*, 2004; and Omemu *et al.*, 2008).

The origin of the ingredients, the food preparations and practices (food cleaning methods, cooking temperature and time, cooling time and temperature, food display methods, display temperature, display time length), the personal hygiene (clothing, handwashing, and habits), food storage methods and temperature (raw materials and cooked ready-to-sell food), food discarding method, utensil cleaning methods, vendors' food safety knowledge (about the potential hazard food they sold), almost all street vended foods have no monitoring methods of food preparation and display at all which can hardly be considered to apply HACCP on the street vended food.

Local authorities should support the form of adequate infrastructure with services such as water supply, toilets, refuse disposal and waste water disposal facilities to ensure the street food safety, and providing the vendors with training and seminars free of charge on food safety knowledge along with certificates issued to street vendors whom completed and received essential basic food hygiene and sanitation training satisfactorily to ensure that they can operate minimum hygiene practice and comply the regulations to improve the safety of informally vended foods which will allow better control and coordination within the street food business (Lues *et al.*, 2006; von Holy *et al.*, 2006; and Gadaga *et al.*, 2008).

Suggestions and Recommendations for Street Vending

Foods sold on streets have many varieties, applying of microbiological testing will cost a lot of money and labors and the outcomes may various. Some research did report street vended foods are acceptable regarding their microbiological levels (Mosupye *et al.*, 2000; Kubheka *et al.*, 2001; Hanashiro *et al.*, 2005; and Gadaga *et al.*, 2008). Food served in informal vending operations may be relatively safe for consumption in most areas; however,

there were still evidence and reports indicated potential risks as a result of contaminated street foods (Lues *et al.*, 2006).

Consumer Protection and Awareness

The consumer has rights to safety, to be informed, to choose, heard (Ekanem, 1998). Nationals and foreign tourists should be warned of the potential hazards of consuming street-vended foods (Estrada-Garcia *et al.*, 2005).

There is still lack of effective system to protect consumers and their rights to safety; consumers are unaware of the link between contaminated food and foodborne diseases. Consumers should use their purchasing power to force vendors to drop unsafe practice and to improve the safety of street foods (Ekanem, 1998). Estrada-Garcia (1997) suggested that advice should be provided for consumers about low-risk or high-risk food since high risk foods are more suspicious to microbiological hazards and information should be provided and knowledge be taught to vendors and consumers, so vendors and consumers will know which types of foods need to pay more attentions in order to prevent foodborne illness. Consumers want the level of sanitation at sale outlet be improved, such as cleaner surrounding, proper handling of food, provision of potable water, provision of washroom facilities, use of hair nets and apron, use of separate utensils for each item, and improvement quality of condiments for street foods (Mankee *et al.*, 2003).

It was suggested that various approaches such as non-governmental organizations and the press could also play a key role in educating the vendors on food and personal hygiene, and educating the public by mass media, national seminars and community health education to enlighten consumers about food safety so as to ensure the standard of safety of street-vended foods (Ekanem, 1998; and Ghosh *et al.*, 2007).

Further Surveys

Current evidence for the effectiveness of food hygiene training is limited, questionnaires are convenient measures of knowledge and attitudes but direct observation has limited value due to staff may alter their behavior under observations which need to be pay more attentions when applying these methods (Egan *et al.*, 2007). Survey of the current practices of street vendors and their knowledge about food safety and determining what sorts of hygiene courses vendors needed and to be educated to ensure food

safety need to done. It seems questionnaire is a better way to investigate the current street food safety if the questionnaire can be carefully planned.

According to the observation methods done by Burt Volet and Finkel (2003) for food vendors and the observation checklist items for food vendor operations by Sun, Wang, and Huang (2012) for night market food vendors, an observation questionnaire (Table 6) was formed after this review. It can be a possible tool for researchers interested in food vending safety and sanitations.

REFERENCES

- Burt B M, Volet C and Finkel M (2003), "Safety of Vender-Prepared Foods: Evaluation of 10 Processing Mobil in Manhattan", *Public Health Reports*, Vol. 118, Nos. 9-10, pp. 470-476.
- Bryan F L, Teufel P, Riaz S, Roohi S, Qadar F and Malik Z-U-R (1992), "Hazards and Critical Control Points of Street-Vended Chat: A Regionally Popular Food in Pakistan", *Journal of Food Protection*, Vol. 55, No. 9, pp. 708-713.
- Cardinale E, Perrier Gros-Claude J D, Tall F, Guèye E F and Salvat G (2005), "Risk Factors for Contamination of Ready-to-Eat Street-Vended Poultry Dishes in Dakar, Senegal", *International Journal of Food Microbiology*, Vol. 103, pp. 157-165.
- Choudhury M, Mahanta L B, Goswami J S and Mazumder M D (2011), "Will Capacity Building Training Interventions Given to Street Food Vendors Give Us Safer Food?: A Cross-Sectional Study from India", *Food Control*, Vol. 22, pp. 1233-1239.
- Cohen E and Avieli N (2004), "Food in Tourism: Attraction and Impediment", *Annals of Tourism Research*, Vol. 31, No. 4, pp. 755-778.
- Egan M B, Raats M M, Grubb S M, Eves A, Lumbers M L, Dean M S and Adams M R (2007), "A Review of Food Safety and Food Hygiene Training Studies in the Commercial Sector", *Food Control*, Vol. 18, pp. 180-1190.
- Ekanem E O (1998), "The Street Food Trade in Africa: Safety and Socio-Environmental Issues", *Food Control*, Vol. 9, No. 4, pp. 211-215.
- Estrada-Garcia M T (1997), "Cholera and Street Food", *The Lancet*, Vol. 350, No. 10, p. 1032.

- Estrada-Garcia T, Lopes-Saucedo C, Arevalo C, Flores-Romo L, Luna O and Perez-Martinez I (2005), "Street-Vended Seafood: A Risk for Foodborne Disease in Mexico", Vol. 5, No. 2, pp. 69-70, <http://Infection.thelancet.com>
- Freese E, Romero-Abal M-E, Solomons N W and Gross R (1998), "The Microbiological Safety of Typical Guatemalan Foods from Street Vendors, Low-Income Homes and Hotels", *International Journal of Food Sciences and Nutrition*, Vol. 49, pp. 27-38.
- Gadaga T H, Samende B K, Musuna C and Chibanda D (2008), "The Microbiological Quality of Informally Vended Foods in Harare, Zimbabwe", *Food Control*, Vol. 19, pp. 829-832.
- Ghosh M, Wahi S, Kumar M and Ganguli A (2007), "Prevalence of Enterotoxigenic *Staphylococcus aureus* and *Shigella* spp. in Some Raw Street Vended Indian Foods", *International Journal of Environmental Health Research*, Vol. 17, No. 2, pp. 151-156.
- Hanashiro A, Morita M, Matté G R, Matté M H and Torres E A F S (2005), "Microbiological Quality of Selected Street Foods from a Restricted Area of São Paulo City, Brazil", *Food Control*, Vol. 16, pp. 439-444.
- Hsieh A-T and Chang J (2006), "Shopping and Tourist Night Markets in Taiwan", *Tourism Management*, Vol. 27, pp. 138-145.
- Jevšnik M, Hlebec V and Raspor P (2008), "Food Safety Knowledge and Practices among Food Handlers in Slovenia", *Food Control*, Vol. 19, pp. 1107-1118.
- King L K, Awumbila B E, Canacoo A and Ofosu-Amaah S (2000), "An Assessment of the Safety of Street Foods in the Ga District, of Ghana; Implications for the Spread of Zoonoses", *Acta Tropica*, Vol. 76, pp. 39-43.
- Kubheka L C, Mosupye F M and von Holy A (2001), "Microbiological Survey of Street-Vended Salad and Gravy in Johannesburg City, South Africa", *Food Control*, Vol. 12, pp. 127-131.
- Lucca A and Freeaz da Silva Torres EA (2006), "Street-Food: The Hygiene Conditions of Hot-Dogs Sold in São Paulo, Brazil", *Food Control*, Vol. 17, pp. 312-316.
- Lues J F R, Rasephei M R, Venter P and Theron M M (2006), "Assessing Food Safety and Associated Food Handling Practices in Street Food Vending", *International Journal of Environmental Health Research*, Vol. 16, No. 5, pp. 319-328.
- Mankee A, Ali S, Chin A, Indalsingh R, Khan R, Mohammed F, Rahman R, Sooknanan S, Tota-Maharaj R, Simeon D and Adesiyun AA (2003), "Bacteriological Quality of "Double" Sold by Street Vendors in Trinidad and the Attitudes, Knowledge and Perceptions of the Public about its Consumption and Health Risk", *Food Microbiology*, Vol. 20, pp. 631-639.
- Mosupye F M and Von Holy A (2000), "Microbiological Hazard Identification and Exposure Assessment of Street Food Vending in Johannesburg, South Africa", *International Journal of Food Microbiology*, Vol. 61, pp. 137-145.
- Muyanja C, Leontina N L, Namugumya B N and Nasinyama G (2011), "Practices, Knowledge and Risk Actors of Street Food Vendors in Uganda", *Food Control*, Vol. 22, pp. 1-8.
- Omemu A M and Aderoju S T (2008), "Food Safety Knowledge and Practices of Street Vendors in the City of Abeokuta, Nigeria", *Food Control*, Vol. 19, pp. 396-402.
- Rheinländer T, Olsen M, Bakang J A, Takyi H, Knoradsen F and Samuelsen H (2008), "Keeping Up Appearances: Perceptions of Street Food Safety in Urban Kumasi, Ghana", *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, Vol. 85, No. 6, pp. 952-964.
- Sun Y-M, Wang S-T and Huang K-W (2012), "Hygiene Knowledge and Practices of Night Market Food Vendors in Tainan City, Taiwan", *Food Control*, Vol. 23, pp. 15-164.
- Tinker I (1999), "Street Foods into 21st Century", *Agriculture and Human Values*, Vol. 16, pp. 327-333.
- Tinker I (2003), "Street Foods: Traditional Microenterprise in a Modernizing World", *International Journal of Politics and Society*, Vol. 16, No. 3, pp. 331-349.
- Toh P-S and Birchenough A (2000), "Food Safety Knowledge and Attitudes: Culture and Environment Impact on Hawkers in Malaysia, Knowledge and Attitudes are Key Attributes of Concern in Hawker Food Handling Practices and Outbreaks of Food

- Poisoning and their Prevention”, *Food Control*, Vol. 11, pp. 447-452.
- Umoh V J and Odoba M B (1999), “Safety and Quality Evaluation of Street Foods Sold in Zaria, Nigeria”, *Food Control*, Vol. 10, pp. 9-14.
 - von Holy A and Makhoane F M (2006), “Improving Street Food Vending in South Africa: Achievement and Lessons Learned”, *International Journal of Food Microbiology*, Vol. 111, pp. 89-92.
 - WHO (1996), “Essential Safety Requirement for Street Vended Foods”, *World Health Organization, Food Safety Unit, Division of Food and Nutrition*, Annex V, pp. 34-35.

