Sudan University of Science and Technology
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Research

Knowledge, Attitude and Practices of Food Hygiene among Street Food Vendors in (Elouzuzab) South Khartoum

المعرفة،السلوك وممارسات سلامةالطعام وسط باعة الطعام في مدينة العزوزاب- جنوب الخرطوم

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Dedication

I dedicate my thesis to my mother soul mainly and to my family my source of strength and inspiration... I also dedicate this to my friend Dr. Mary Ayom who always supports me during critical situations.

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Abstract

This study was conducted to evaluate food safety in street-vended foods in El ouzozab South of Khartoum city in December 2018 to assessment of bacteriological profile, using standardized survey tool containing 41 questions to test food safety knowledge, attitudes and the practices about 170 street vendors in the study was carried out. The analysis of demographic characteristics revealed that the 60 percent of participants were females and their age > 40 years (43.5) percent, close half of the vendors were with illiterate education (44.1) percent and more than half of them were married (64.2) percent. Concerning health and personal hygiene knowledge, these people agree that one of the most important responsibilities of the food handlers is washing hands (92.9) percent. Most of respondents knew that lack of hygiene cause food-borne disease and some of them recognized the terms food contamination and foodborne diseases. Six (6) samples of different sites were taken from ready to eat meals (Tagalia, Roob ,Dammah, Kesra,Taameya and foul) in sterile containers and sent to laboratory to isolate food borne bacteria; Salmonella, Echerichia coli and Staphylococcus spp and (TVBC). The result of (TVBC) Tagalia 27*cfu/g 8* cfu/g, Roob 49*cfu/g 15*cfu/g, Dammah 53*cfu/g 21cfu/g, Kesra 19*cfu/g 8*cfu/g, Taameya 59*cfu/g 29*cfu/g and foul 32*cfu/g 19*cfu/g ,TVBC Less than the pathogenic limit, isolation was negative no pathogenic bacteria maybe samples were taken from cooked meals. Result of observation for street vendors showed that the insuring food hygiene is very difficult to practice on street in setting where resources are scarce and surroundings are of low environmental and sanitary standards.

ملخص الدراسة

اجريت هذه الدراسة في ديسمبر 2018م لتقييم مدى معرفة الباعة بسلامة الاغذية وممارساتهم وكذلك لتقييم مستوى التلوث الجرثومي في منطقة العزوزاب جنوب مدينة الخرطوم بالسودان وذالك بأستخدام استبيان يحتوى على عدد واحدا واربعين سؤالً لاختبار معرفة الباعة وممارساتهم الصحية المرتبطة بالاغذية، حيث كان عدد المشتركين في الدراسة واحد وسبعون ومائة من الباعة وقد اظهرت نتائج الدراسة فوق النصف من المستهدفين اناث بنسبة ستين بالمائة منهم ثلاثة واربعين فاصل خمسة بالمائة فوق سن الاربعين، وتقدر نسبة غير المتعلمين منهم باربعة واربعين بالمائة ونسبة الباعة المتزوجين اربع وستون فاصل اثنين بالمائة وفيما يتعلق بمعرفتهم بالصحة والنظافة الشخصية فأن معظم المستهدفين في الدراسة اثنان وتسعون فاصل تسعة بالمائة منهم يدرك ان غسل اليدين مهم للغاية بالنسبة للذين يتعاملون مع الاغذية، كما أن معظم المستهدفين يعرفون ان عدم النظافة يودي الي الاصابة بالامراض المنقولة بواسطة الغذاء و البعض منهم اظهر مقدرة في التعرف علي مصطلحات التلوث الغذائي والامراض المنقولة بواسطة الغذاء. ايضا اشتملت الدراسة على فحص مستوي التلوث الجرثومي للغذاء حيث تم اجراء تحليل معملي لعدد 6 عينات اخذت من من طعام معد للاكل (تقلية، روب، دمعة، كسرة، طعمية، فول) من باعة مختلفين وذالك باخذ عينة من الطعام ووضعها في حاويات معقمة وارسلت الي المحتبر لفحص وجود البكتريا الممرضة و نوعها (القولونية العضوية اي كولاي ، السالمونيلا والبكتريا العنقودية الاستافيلو كوكس) وعدها , حيث كانت نتائج العد كالاتي التقلية 8* cfu/g 27*cfu/g ،الروب15*cfu/g 49*cfu/g ، الدمعة 21cfu/g 53*cfu/g ، الكسرة ,8*cfu/g 19*cfu/g، الطعمية 29*cfu/g 59*cfu/g و الفول19*cfu/g 32*cfu/g في التخفيف الرابع والخامس علي التوالي اشارعد البكتيريا الي وجود مستعمرات اقل من الحد الادني لاحداث الامراض وايضا اظهرت اختبارات فحص البكتيريا سلبية العينات المفحوصة لانواع للبكتريا الممرضة سالفة الذكر ذا وهذا لا يعني تطبيق الباعة للاشتراطات الصحية وانما العينات اخذت من طعام مطبوخ السبب الذي ادي الي عدم وجود البكتيريا الممرضة. نتائج المراقبة والملاحظة لبائعي الاكل بالشارع اظهرت انه من الصعوبة بمكان الحفاظ علي صحة الغذاء وممارسة الاشتراطات الصحية علي مستوي الشارع وذالك نسبة الي فقر الخدمات الاساسية في محيط بيئي ذو مستوي صحي منخفض.

Introduction

The World health theme for 2015 was "Food Safety" and the slogan was "Farm to Plate, Make Food Safe" (WHO, 2015). This highlights the importance that the World Health Organization places on the need to globally address in a coordinated manner, the potential threats posed by unsafe food which is a consequence of the breakdown of food hygiene with the subsequent risk of the emergence of foodborne illnesses along the pathway of the entire food supply chain, of which the food vendor is a critical component.

Foodborne diseases remain a major public health problem globally (Zeru *et al*., 2007; FSANZ, 2001). In developing countries, up to an estimated 70 percent of cases of diarrheal disease are associated with the consumption of unwholesome food (Annor, Baiden, (2011). Food contamination can occur at any point during its preparation, bringing to bear the importance of food safety and hygiene in the prevention of foodborne diseases (Green *et al.,* 2005; Afolaranmi(2015). Street food vending is a large source of employment and contributes significantly to household incomes.

Street foods are defined by the FAO as ready to- eat (RTE) food and beverages prepared and or sold by vendors and handlers especially in streets and other similar places for immediate consumption or consumption at a later stage without further processing or preparation (Food and Nutrition, 1989). It is well established that urbanization is taking place quickly in Sub-Saharan Africa, and it is one of the greatest challenges of the 21st century (Amponsah *et al*, 2010). The demographic expansion, coupled with the urbanization requirements, has given new dimensions to this activity. Many urban dwellers obtain a significant portion of their diet from street foods-prepared, increasing considerably the street food demand in major cities. Ready-to-eat salads constitute an expanding food commodity nowadays served to these consumers. Salad can be defined as food made primarily of a mixture of raw vegetables and/or fruits (Uzeh *et al.*, 2009; Rajvanshi, (2010). It is clearly evident that a large number of vegetables are a good source of antioxidants and phytonutrients, and have health-protecting properties (Vrchovska *et al*, (2006), to improve human well being. In contrast with these advantages, the salads containing raw vegetables may be unsafe, mainly because of the environment under which they are prepared and consumed (Taban *et al.,* (2011) and also of the lack of personal hygiene (Cuprasitrut *et al*., (2011). These foods have been identified as vehicles of bacterial agents and generate food safety problems, especially gastroenteritis (Beuchat, (2002).

In Sudan, food safety is a major concern with street foods. These foods are generally prepared and sold under unhygienic conditions, with limited access to safe water, sanitary services, or garbage disposal facilities. Hence street foods pose

a high risk of food poisoning due to microbial contamination, as well as improper use of food additives, adulteration and environmental contamination FAO (2003) equipment and other sources. On the other hand there are many types of foods all over Sudanese vessels beside other sources of contamination streets, which include different types of cooked foods and food products may transmit certain food such as meat, chicken, vegetables, bean (fib bean, poisoning by microorganisms that can lead to either food Madame's), lentils, 'Tamie', 'Dakwa' (peanut butter) and borne infection or intoxication. Infection is caused by some other traditional foods besides ice cream. Salmonella, Bacillus cereus, pathogenic Escherichia coli, these cooked meals are usually consumed within 1-14 hours and other pathogenic microbes. Intoxication occurs when hours after being prepared. Cooked bean (medammes) and toxins are released in food by microorganisms like lentils are usually consumed in breakfast after 14 hrs of Staphylococcus aurous and Clostridium botulinum (Elfaki *et al*, (2011). Isolated bacteria from cooked meals, bottled drinks, and fresh juice were; Escherichia coli, Staphylococcus aurous and Bacillus sp. The viable bacterial counts were 4.6 CFU/ml, 3.7 CFU/ml and 4.1 CFU/ml for cooked meals, bottled drink and juice, respectively (Abdalla *et al,(*2009).

Recently, street food has become one of the major concerns of public health and a focus for governments and scientists to raise public awareness. Hence, taking these factors into account this study is undertaken to assess Knowledge, Attitudes, and Practices of hygiene among street vendors and factors that contribute to contamination of various street- vended foods consumed lavishly at street sides in Eluzozab- South Khartoum city.

Problem Statement:

Increased public awareness of food-borne diseases has shown that food safety is an important issue to producers, processors, distributors, regulatory authorities and consumers. In addition, the establishment and implementation of adequate measures for consumer health protection against those have been difficult in developing countries. Thus, food-borne diseases continue to burden public health (Khalid, 2016).

Objectives

Objectives of the study were:

1. Assess the knowledge, attitude, and practices related to food safety among street vendors in Eluzozab
2. Describe the knowledge of vendors with regard to food safety and hygiene.
3. Determine the attitudes of vendors towards food safety and hygiene.
4. To determine the bacterial load
5. Factors that contribute to contamination of foods vending on the street.

Chapter one

Literature Review

1.1 **Food safety:**

"Is used as a scientific discipline describing handle, preparation, processing, and storage of food in ways that prevent food borne-illness" (Wikipedia).
Food safety is the assurance that food will not cause any harm to the consumers when consumption in its current status and as it is (FAO, WHO, 2001).
Food-borne diseases and zoonoses exert a major toll on health as thousands of millions of people fall ill and many die as a result of unsafe food. Serious outbreaks of foodborne diseases and zoonoses have been documented on every continent to explain both their public health and social significance. Due to this, WHO (2000) recognized food safety as an essential public health priority and later on adopted the WHO global food safety strategy (WHO, 2002). According to the WHO (2000) global food safety strategy, traditional food safety management systems have not been effective in preventing food-borne diseases and zoonoses over the last decades. The strategy, therefore, advocates food safety programs based on a broader science-based concept of risk assessment, risk management through process controls along the entire production chain and risk communication. This is a farm to table approach and involves considerations of every step in the chain, the community and all actors from raw material to consumption. The strategy also advocates sustainable agriculture production systems and redirection of some of the existing approaches to ensure they meet the challenges of global food safety (WHO, 2002).
All food handle; farmers, food producers, workers in markets, food service establishments and other preparers have a responsibility to keep food as much safe as possible (Abdelrazig *et al* 2017). Ministry of Health (MoH) represented health authorities which control safety problems through implementing practices as standard operating producers (SoPs), but still more efforts needed (Abdelrazig *et al* 2017). Study carried out in Owerri, Imo State- Nigeria To assess the knowledge, Attitude and hygienic practices of food vendors by Iwu *et al*, 2017)reported Food vendor a played critical food safety role in farm to fork continuum that was needful for the prevention and control of borne-diseases and therefore any lack of its understanding by the food vendor posed a serious challenge to food safety (Iwu *et al*, 2017)

“Unsafe food creates a vicious cycle of disease, diarrhea, and malnutrition which significantly impedes public health and socio-economic development” (Iwu *et al*, 2017).

1.2. Hygiene:

The word hygiene has promoted from the Greek term “Hygeia” which means “Goddess of health” (Alaa, 2018). Hygiene is “the science and art which is associated with the preservation and promotion of health” (Alaa, 2018). According to the world health organization (WHO) hygiene refers to situations and practices that help to preserve health and prevent the prevalence of diseases (WHO, 2009). It is a set of practices performed to maintain health (Wikipedia).

1.2.1 **The five key principles of food hygiene, according to WHO, (2010), are:**

1. To prevent contaminating food with pathogens spreading from people, pets, and pests.
2. To separate raw and cooked food to prevent contaminating the cooked food.
3. To cook food for the appropriate length of time and at the appropriate temperature to kill pathogens.
4. To store food at the proper temperature.
5. To use safe water and raw materials.

According to Alaa Elsier on the study to Evaluation Food Safety Knowledge and Personal Hygiene Practices given the wide range of processing technologies and food products, and increasing production volumes as part of the modern development of the food industry, ensuring appropriate timely implementation of sanitary practices is an essential factor in safe food production. It was in customers‟ interest to consume perfectly safe food products, while it was in producers‟ interest to achieve the longest possible shelf life of a product. To this end, maximum attention should be given to hygiene during the production process. Considering the presence of not only saprophytes but also microbial pathogens in micro-populations of production lines and work environments in the food industry, it is necessary to continuously maintain a high level of hygiene in the production plant, using appropriate cleaning and disinfection procedures. Cleaning and disinfection should be taken as a joint operation of the hygiene package. (Alaa, 2018).

1.2.2 Personal hygiene:

The concept of Personal Hygiene: Personal hygiene involves different habits i.e., washing hands and brushing teeth which keep bacteria, viruses and fungal far away from our bodies. Moreover, these habits will help us to protect our mental health and activity. Also, good personal hygiene would help us to keep feeling good about ourselves. Since those who did not take care of their personal hygiene i.e., dirty clothes, body odor, and bad breath will suffer from discrimination and this would mainly lead to mental problems. But the most important point in this subject is that all people have their own hygiene but some people do it better than others, this mainly depended on each person's culture, society and family norm. As hands were an important mode of transmission of infectious disease among school-aged children, simple hand washing with soap helps to protect children from the two common global pediatric killers (diarrhea and lower respiratory infection), hand hygiene significantly reduced illness-associated absences in elementary school students by 26 percent(Alaa, 2018). Critical times for hand washing include after using the toilet, after cleaning a child, and before handling food. The personnel should undergo a health examination every year if necessary temporary health examination should be affected. Persons suffering from effects of food health disease should leave their work from the post of food processing the person who engaged in aquatic products processing and management should maintain personal hygiene, and get into the good health habit. It is prohibited to bring the things no business with work into the workshop the personnel should; wear work clothes, hat, boo clean and disinfect the hands, gloves, etc. used in processing clean and disinfected, and kept intact without breaking. “The work clothes should be preserved and managed concentrate, unfairly clean and disinfect unfairly grant”. Poor Personal Hygiene, Improper Holding of Food and Contaminated Food Surfaces/Equipment (Alaa, 2018). The body’s cleanness (Wikipedia).

1.2.3 Food hygiene:

Are the condition and measurer necessary to ensure the safety of food from farm to fork (WHO).

The principle of food hygiene means that should be minimal level handling practices of food items (Abdelrazig *et al* 2017)

Level of cooking hygienic practices among workers and handlers in Al- nhood restraints 33.21 percent were good, 47.57 percent poor and 27.71 percent bad (abdelrazig et al 2017). Female worked in Al-nhood restraints hadn't; protective clothes, hand gloves, and medical fitness card. Cooking and personal hygienic practices among handlers and workers were poor (Abdelrazig *et al* 2017).

1.3. Street foods:

Defined as ready-to-eat foods prepared and/or sold by vendors and hawkers especially in the streets and other public places (FAO/ WHO, 2010).

Another defined "The ready –to eat food and beverages are prepared and \or sold by vendors or hawkers mainly in street or other convenient public places of work schools, hospitals, railway stations and bus terminals (Eshraga, 2013).

Elwathig Khairalla (2015) in his study Assessment of Food-Safety Status of Street-Vended Foods in Khartoum State - Sudan reported about type of food eaten; Finger food was food eaten directly using the hands, in contrast to the food eaten with a knife and fork, chopsticks, or other utensils. Fast food is food that can be quickly prepared and presented; most street foods were both finger and fast food (Elwathig, 2015)
Street food generally prepared and sold in bad condition (unhygienic) no; safe water, sanitary services or garbage disposal facilities. (Eshraga, 2013).

1.3.1 **Street Food Vendors**

A number of studies had examined the characteristics of vendors and had found that street food vendors didn't form a homogenous group, but differ according to various socio-economic and demographic criteria. With refer to the mode of selling; vendors could be largely classified into stationary and ambulatory. It has been found that stationary vendors, who sold their wares from small stalls, kiosks, and so forth, were the predominant type in most of the countries studied (Elwathig, 2015). Ambulatory vendors refer to those that push carts around selling their products. Most vendors operated from selected strategic locations, involving bus and train stations, markets and shopping areas, commercial districts, outside schools and hospitals, residential suburbs, factories, and construction sites. In some places, it appears that vendors tend to concentrate in downtown commercial areas, but various country studies have shown this to be the exception in all locations except in Bangladesh and Thailand. Nigeria, 23 percent of vendors were located in residential areas. It is also postulated that street-food vendors, owing to their lack of or no education as well as being poor, lack an appreciation for safe food

handling. Thus, this together with the surroundings that they were prepared and sold in street food was perceived to be a big public health risk (Elwathig, 2015).

1.3.2 Safety of Street Foods

The main health hazard associated with street foods was microbial contamination, although pesticide residues, the transmission of parasites, the use of unpermitted chemical additives, environmental contamination and limited access to safe water have also been identified as possible hazards. The potential for the contamination of street foods with pathogenic micro-organisms has been well documented and several disease outbreaks have been traced to the consumption of contaminated street foods (Elwathig, 2015).

Food risk is influence by food type, practices hygiene, and method of preparation, water access, handling, exposure temperature, and holding time. In general, cereal and bakery, products with low moisture content, products that had been adequately sugared, salted, or acidulated, and some fermented products were less likely to support bacterial growth as opposed to dairy, egg, and meat products. Dishes containing raw ingredients or made with ice were also high-risk items. The risk of microbial contamination is dependent on the type of Restaurants' food and how the food is prepared. (Ahmed, 2015).

According to **Elwathig Khairalla (2015)** Food that was cooked immediately before to consumption is safer than those which had been cooked and preserved at ambient temperature. Other factors implicated in causing microbial contamination involved poor food preparation and handling practices, inadequate storage facilities, and a lack of adequate sanitation and refuse disposal facilities(Elwathig, 2015). In Ghana, in a study that investigated the microbial quality of street foods sold in Accra; Shigella sonnei, enteroaggregative, Escherichia coli and Salmonella arizonae were the pathogens isolated from some food samples. Also In Ethiopia, identical study isolated Bacillus spp, Staphylococci, and Micrococci as the dominant groups in some foods. The health risk from street foods might be no greater than that posed by foods or dishes from other sources such as in restaurants. Two studies carried out in India found that the microbial quality of Restaurant's food was equivalent to, if not better, than that of foods bought from hotels and restaurants. In South Africa, a comparative study found no significant difference between 116 formal and 11 vendors' food informal related to microbiological food quality. With regard to potential risk, formal vendors had that vending experience, used some precautions in food preparation and had better hygiene practices. However, whilst food from the informal vendors was hot, food from formal food vendors tended to be cool and 73 percent preserved leftovers for sold the next day, both of which were potential risks for microbiological contamination (Elwathig, 2015).

1.3.3 **Risk Factors associated with Street Foods:**

Street vended food has become a big public health issue worldwide and perceive to be big source of food-borne diseases, due to lack of basic food safety knowledge and practices of the vendors, mentioned that the big sources contributing to microbial contamination were the place of preparation, utensils for cooking and handling, personal hygiene, raw materials, food preparation, preserved and reheating, time and temperature abuse of cooked foods, and waste disposal. (Elwthig, 2015).

These factors are:

(a) Food handlers and personal hygiene:

Personal hygiene is an important factor in food safety, maintaining a high standard of personal hygiene most importantly hand washing, would lead to protect food contamination and the spread of microorganisms. A number of diseases can be prevented by adopting good practices of personal hygiene. Performing correct personal hygiene practices can lower the risk of diseases and play an important role in preventing the spread of them (Ahmed, 2015).

However, handlers are considering as contributing risk factors in food contamination and transmission of foodborne illness to consumers. Studies have involves that most food-borne diseases outbreaks occurred in food handling establishments are attributed to poor preparation practices and food handlers. Inadequate hygienic status, only 3.4 percent of the food handlers who practice proper hygiene, most of the handlers do not practice proper hand washing technique and 93.1percent failed to avoid contamination from taps after hand washing. Poor personal hygiene would lead to food contamination with oral-fecal parasites and spread of the diarrheal diseases. Another study assessed the level of personal hygiene among street food vendors and possibility of food contamination with eggs and cysts of parasites, they found that 97 percent of the vendors infected with parasites, only 3 percent free from parasites, toilet facilities represent 75 percent, and only 25 percent had water and hand washing done without soap. Therefore, it is important to educate food handlers and encourages them to stop working when suffering from diarrhea, vomiting, jaundice, fever, sore throat, and discharges from the ear, eye, or nose. Personal hygiene was the principle of maintaining cleanliness and removal of dirt, soil, food residue and objectionable body odors. (Elwathig, 2015).

According to FAO, 1997 every food vendors the business should:

1- wear identification tag if issued by relevant authority 2- dress clean protective clothing such as apron, and clean all parts of the body 3-refrain from unhygienic practices, such as smoking chewing gum, sneezing, coughing, touching body orifice during preparation or storages 4- change apron when it became spotted 5-

avoid wearing jewelry, keep nail short so they were easy to clean, and regularly handwashing with soap and clean water (FAO, 1997).

(b) Hand washing

Hands are important vehicles to cross-contaminated foods from food contact surfaces, utensils and cooking equipment. Maintaining a high standard of personal hygiene is an important way to prevent such contamination. Organisms reside in the gut can be transferred to food through hands after failing to apply correct hand washing. Effective hand washing with soap and water is most important to the alimentation of biological and chemical hazards and preventing the spread of pathogens (Elwathig, 2015). Correct hand washing with soap and water was vital to reduce the spread of infection especially in high-risk areas, and could be prevented a high proportion of cases during outbreaks Proper hand washing technique can reduce illness spread through fecal-oral transmission, diseases spread through indirect contact with respiratory secretion, urine, saliva or any of the moist body substances, a study on 27 public schools in Brazil to assess the hygienic practices of food handlers, found that all the handlers did not practice proper hand hygiene, 55.6percent of them their hands contaminated with fecal coliform, and 51.9percent were not subjected to medical examination. It is necessary that food handlers practice hand washing with soap and clean water after engaging in activities which can introduce biological and chemical or physical hazards; hand should be washed when entering the food handling area after handling raw foods, using the toilet, holding garbage, touching animals, holding money and contact with toxic substances such as pesticides and disinfectants (Elwathyg, 2015).

According to WHO, (2009) hand washing technique with water and soap should; 1- takes 40-60 second 2- first wet hands with soap rub together 3- apply soap and rub hands (palm to palm- right palm over left dorsum- palm to palm with fingers) 4- wash front and back, between fingers and under nails, 5- rinse hand with water 6- dry hands with clean towel 7- turn of faucet with towel. (WHO, (2009)

(c) Raw materials:

Food can be contaminated at all stages of the food chain from harvest or slaughter to final preparation and handling. The raw material is a critical point and contributing factor to foodborne illness. Raw food materials such as meat, poultry, seafood and their juices containing harmful microorganism that might be transferred to food during preparation and storage and posed a potential health risk. In most cases mean bacterial counts of raw materials are higher than cooked food (Almed, 2015).

This attributed to the fact that raw foods might be exposed to pathogens or toxins at production sites, for example, meat can be contaminated in the slaughtering stage, vegetables can be contaminated from irrigation water, soil and residues of

fertilizers or pesticides in farms. In addition to that excessive delay during transport can increase time for microbial grow and natural process to occur, as well as physical damage during transport enable the microorganism to access nutrient-rich underlying tissues, where they can grow rapidly. Raw foods were readily contaminated by fecal materials, out of (213) raw food sample involving raw meat, raw milk, and fresh juices sample, were found positive for Shiga toxin-producing by E. coli. Also found a high concentration of Aluminum exceeded the standard upper limit of food in some raw food and food additives. One of the most important principles in food safety is a separation between raw and cooked foods, as well as the use of separated equipment, knives, and cutting boards, for handling raw foods during processing and preserved to avoid recontamination. In section and hand sorting for raw food help to alleviated hazards, reducing contamination, and ensure that food would meet elements of quality and safety. Raw materials should be preserved in a way to protect them from contamination and deterioration of the food, in refrigerator food should be stored in small containers on the top shelf of the fridge to kept leaks from contaminating preserved food (Elwathig, 2015).

(d) Water and Ice

Water was a critical point in street food and can be contaminated at the source in many ways or during storage. Such contaminated water posed a threat to public health when it used for drinking, cooking, processing of food, washing equipment, and hand washing. Mutable studies stated that water was a risk factor for endemic diseases and implicated in many outbreaks of human diseases, both in developed and developing countries. Consequently use of safe water in vending operation is a very important issue in food safety and can reduce the risk of waterborne diseases. In the street vending sites potable water should be used for drinking purposes and preparation of foods or beverages, running water should be available at close distance. On the other hand, freezing didn't remove chemical and biological hazards, contaminated ice can be a big contributor to transmission of waterborne disease, thus ice should be given from approved source, protected from cross-contamination, moreover transported and stored in sanitary conditions (Ahmed, 2015).

(e) Preparation and processing

Preparation is set of methods aimed to transform food or raw ingredient to food for human consumption, food preparation, and processing was defined as any change happened to food by heating, milling, grinding, smoking, mixing, coating, cutting, drying, to alter it was eating the quality or shelf life. Proper preparation and processing techniques were essential to ensuring the safety of street vended-food. Preparation and processing operations should be adequate to eliminated hazards to an acceptable level, control of pathogen growth, and prevention of physical and

chemical hazards. However, preparation and processing in the unhygienic environment in the presence of infected food handlers are contributing factors to food-borne diseases and the incidence of severe outbreaks such as Cholera. Furthermore, place of preparation, raw materials, utensils for cooking and serving, preparation of foods in advance of consumption, storage at ambient temperature, and time-temperature abuse in cooling or reheating are important issues and big sources for food contamination and food-borne diseases. A study highlighting on risk factors associated with street vended food in Kampala by investigating a total of 225 street food vendors the results revealed that vendors failed to practice proper food handling in preparation of foods, running water is not available, improper management of waste disposal, food handled at ground level and exposed to flies. Physical methods of food preservation such as heating play an important role in food safety. Various forms of heating such as boiling, frying, roasting, are important methods for killing microorganisms in food and ensuring that food is safe. Cooking food to a temperature of 75ċ for two minutes will kill all bacteria present and help to ensure that food was safe for consumption. The separation between raw and prepared or cooked food in preparation and processing operation is essential principle to prevent contamination from raw food especially meat, poultry, and seafood to cooked food, such contamination may be caused by direct contact or cross-contamination from equipment, utensils, cutting board, knives, surfaces and during storage. Washing with safe water for foods to be consumed raw was necessary to reduced contamination to an acceptable level, moreover, it is very useful for the elimination of potential physical hazards. Improper practices regarding thawing frozen foods would lead to foodborne disease. Not only thawing foods in counter at room temperature is unsafe, but also thawing them at hot water might lead to foodborne disease, because of that bacteria have been found in foods before freezing could multiply to sufficient numbers to caused illness, therefore it is important and safe to thaw frozen foods in refrigerator in advance of cooking to ensure adequate cooking (Ahmed, 2015).

(f) Handling and preserved of prepared food

Cooking and manipulating food after cooking, preserving, holding cooking food and reheating leftovers are critical control points associated with street food vendors. Holding foods after cooking at ambient temperature for several hours reported as risk factors contributing to the occurrence of food-borne diseases. The study tested a total of 114 food samples collected from street vendors; the laboratory results showed that 68 percent of samples had colony count exceeded the acceptable level, 37 percent was Bacillus cereus, 41 percent positive for Staphylococcus aureus, 97 percent at temperature range of 15-44 when collecting, reported high colony count of bacteria including Bacillus cereus and E. coli from cooked food held at room or outdoor ambient temperature several hours during the

day and from food held overnight. The most important equipment for keeping food safe was a refrigerator. It was recommended to refrigerate perishable foods such as fruits, vegetables, meat, poultry, and fish below 5ċ within two hours after cooking and place them in smaller quantities in shallow containers at the coldest section of the refrigerator. Proper food storage not only preserved food quality but also prevented food-borne disease. Inadequate temperature control and ignoring regular cleaning would lead to the survival of microorganism on refrigerator surfaces and causes cross-contamination to other foods (Ahmed, 2015).

The failure to adopt suitable food temperature control is included in food-borne diseases and the incidence of outbreaks. According to Food Standard Agency (FSA) there was, therefore, a needed to maintain good management practices to ensure food safety, the minimum holding temperature for foods to be presented hot was not less than 63ċ, and that for food to be presented cold was below 8ċ to stand or slow down microbial growth especially that foods were likely to support the growth of pathogenic microorganism (Elwathig, 2o15).

Maintaining food safety and protecting food from contamination during transportation of food is a challenge to street food vendors. The vehicle used for transport food should be cleaned regularly and effectively to removed soil and food residues that may support the growth of pathogenic bacteria, and should not carry animals along with foods to minimize the possibility of contamination residues. That five food safety hazards related with transportation of food; 1- lack of security for transportation unit or storage facilities, 2- improper holding practices, 3- improper temperature control, 4- improper loading practices and sanitation of equipment, and 5- cross-contamination (Elwathig, 2o15).

(g) Vending unit, equipment, and utensils:

Vending unit, equipment, utensils, crockery, and cutlery used in food preparation and serving can be a source of contamination and causal factors of foodborne illness when they aren't thoroughly cleaned and sanitized. The design and construction of cooking utensils and equipment are important to allow effective cleaning and sanitizing, they should be designed and constructed from appropriate materials without a groove or sculpted surfaces, free from pockets or crevices, and do not release toxic materials or affected by sanitizing agents (WHO, 2002).

However, there is a potential health risk related to utensils and cooking equipment when they are misused by street food vendors. Some studies stated that most vendors didn't renew water for washing and rinsing utensils. Evaluated the hygienic condition of dishwashing water for microbiological assessment, it was found that unacceptable levels of different pathogenic bacteria like; Coliforms, Staphylococcus aureus, Salmonella and Shigella in food vending site. On study which carried out to evaluate the sanitary status of food establishments, a high potential risk of infection in a food establishment, 44.3percent of the food utensils

found with the unsatisfactory level of bacterial colony count, 45.5percent were found contaminated with coliforms. Cleaning and sanitizing of food contact surfaces of equipment and utensils help to reduced contaminating safe food during processing, preparation, storage, and serving. The proper manual cleaning process requires three washing bowls, the first bowl containing detergent and soap to removed greases, soil and bacterial film the second bowl for rising to remove food particles or washing compound, the third bowl for sanitizing by rinsing in hot water 80ċ (Elwathig, 2015).

(h) Point of sale

Following rules of environmental hygiene in the design of the workplace, selecting appropriate premises and vending sites, provision of basic sanitary facilities and infrastructures are necessary factors to ensure food. Stationary sales points should be designed and constructed in a way made them easy to clean and disinfect, able to reduced food contamination and should have suitable supply of water as well as located in a place away from dust, sun, rubbish and sewerages, away from infestation by pets, and not used for purposes other than food. Out of 160 sell points studied on food safety issues, only 1.8percent of the premises met all the hygienic requirements. A study conducted to assessed the hygienic status in pilgrim catering establishments in regard to location and surrounding environments of food premises in Makkah and Al Madinah city Kingdom Saudi Arabia, the study associated to most of the establishments 78 percent had violation notes, the surrounding environments were not good in 98 percent of them, unclean roofs observed in 39 percent of establishments, cracked and broken walls and floor in 52 percent of them, doors and windows neither clean nor pest-proof in 48 percent of them, insect traps not enough in 63 percent of establishments, inadequate cleaning for food utensils and containers in 45 percent of the establishments and improper waste management in 57 percent of the food premises(Ahmed,2015).

However, deficiencies in basic hygiene standards and facilities in fast food premises can be a causative agent leading to severe illness and incidence of outbreaks. (Giraudon *et al.*, 2009).

Therefore, regular inspection and monitoring of food premises were necessary to ensure compliance with basic food hygiene standards. (Elwathig, 2015).

(i) Waste management

Restaurants' food premises should be located away from food preparation, storage, handling, and serving area to avoid contamination, as well as supplied by liquid and solid waste disposal system, approved and comply with authority requirements, to ensure that the system able to carry away the wastes. All solid waste should be removed from the working area and disposed into adequate containers. However, failure to dispose of wastes and ignoring routine inspection of disposal area would cause health problems involving contamination, bad odor

and infestation by pests, flies, insects, rats, and wondering dogs. So the design and the construction of the waste containers should adequately contain the volume of accumulated solid waste and easy to handle for disposal (FAO, 1997, Ahmed, 2015).

1.3.4 **Importance of Street Food in Urban Areas:**

A large proportion of ready to eat foods in developing countries are sold on the street (Elwathig, 2015).

According to the Food and Agriculture Organization, 2.5 billion people worldwide eat street food every day (Ahmed, 2015)

In Latin America, street food purchases account for up to 30 percent of urban household spending. In Bangkok, 20.000 street food vendors provide city residents with an estimated 40 percent of their overall food intake. As well as being cheap, street foods can also be nutritious. A study in Calcutta, India, found that an average meal contained about 30 grams of protein, 15 grams of fat and 180 grams of carbohydrates (Ahmed, 2015)

Increased dependence of street food has been identified as one of the Characteristics of urban food distribution systems driven by changes in the urban way of life and poverty in developing countries, Street foods have already become a common feature of civilian life. The phenomenon of increasing street food will be only increasing due to poverty and time constraints to survive in developing countries. With the increasing pace of globalization and tourism, the safety of street food has become one of the major concerns of public health, and a focus for governments and feeds millions of people daily with cheap and easily accessible food. (Elwathig, 2015).

1.4. Knowledge, Attitudes, and Practices (KAP):

1.4.1 Knowledge: accumulates through learning processes (formal, informal) personal experiences and experiential sharing (Tracy, 2011).

1.4.2 Attitudes: includes concepts related to thinking, feeling, and behaving of people, involves cognitive, emotional and behavioral component meaning that knowing, feeling and behaving (action) (Khalid, 2016, Keller, 2007).

Health-related studies revealed that there are some factors other than knowledge influencing treatment-seeking practice such as socio-cultural, environmental, economic and structural factors (Tracy, 2011).

1.4.3 Practices: Eshraga Abdallah Ali Elneim On study determined some practices of hygiene and handling, preparation and preservation of food vendors

inside and outside base schools in Sinja city, all vendors were women. Choosing randomly sample showed current situation in schools foundation in sinja used interview with women vending street food inside and outside the school to assessed some practices such as personal hygiene practices, cooking, skills, food handling, place Food preparation, environmental conditions, and storage (Eshrag, 2013). The **Result showed** the street foods sold inside and outside schools consisted of local snacks, sandwich (Salad tomato, Tamiya), Hibiscus with chili and peanut butter (dakowa), Aradeb with chili and peanut butter, Ajur, chili and dakowa, paleila and fresh fruit and vegetables also cooking method, trading, and contamination. The number of respondents was fifty-four women half present of them none educated. Hand washing: 50 percent washed their hands before preparing food, more than half not washed after used toilet and 18.56 percent washed their hands with soap more than three times a day. Personal hygiene: 51.85 percent neatly dressed (clean), 64.81percent had the head covered, 38.88 percent well-kept fingernails and 12.96 percent of women wearied only rings when preparing food. Preparation method of street food (cooking, handling, and conservation): 73.30 percent are cooking before eating, 48.14 percent was cooking early morning, 22 percent were selling foods cooked in the cooking pot, 40.74 percent put cooked foods in plastic bags, 20.37 present of foods opened, 12.96 percent of the foods were heated before handling. Food circulation: 31.48 percent of the foods sold in paper and 46. 29 percent in plastic bags remaining food saving: 42.59 percent in the fridge and 38.88 percent in the work table in the kitchen and 22 percent in the kitchen cupboard. Vendors and sites selling characteristics: 27.40 percent sitting outside of schools 42.59 present were inside schools cleaned the site, 20.37 percent of them had bin baskets, 20.37 percent put foods in the table before sold and 79.62 percent on the earth (poor hygiene). The food covered always 44.44 percent, some cases opened 49.74 percent and 59 percent utensils of water placed on the earth (floor) Information health and safety knowledge (respondents=35) the level of knowledge of the etiology of diseases transmitted through food, 44.44 percent poor level of knowledge, sources of information about health and food safety was radio top 40.74 percent and less than grade 3.7 present of the health worker. Unhealthy practices by women street food vendors lead to contamination of foods which could cause poisoning and diarrhea among Students and there was a lack of knowledge of the causes of contamination foods (respondents) (Eshrag, 2013).

Khalid's study reported "Studies have found that food safety training is positively associated with self-reported changes in food safety practice and improved attitude", others studies showed that training helped the handler to improve safety food knowledge, the other fond training had not related with knowledge improved (Khalid, 2016).

The study conducted by Abdelrazig et al, investigated food hygiene practices among Food Handlers in Restaurants of Al-Nohod Locality Market-West Kordofan state -Sudan-2017, the study showed that majority of vendors were male 70 percent and 57 percent had an apron in contrast 30 percent female not wearing aprons. Having currently medical fitness cards: men 70 percent and women hadn't. Finally, The study identified that cooking and personal hygienic practices were poor among food handlers. (Abdelrazig et al 2017).

Another study by Hatim *et al* to assess the health status of some food presented at Al Sooq Al rabbi Market. Method used choosing thirty samples randomly in Khartoum state (Agashi, Taameya, and Shawarma) sandwiches. Data were inspected by using laboratory Analysis, and observation of the microbiological parameter study was a total viable bacterial count (TVBC). Result: Agashi (meat) The TVBC ranged from 3.8*104 cfu/g to 2.26*108 cfu/g. Sample collected from Alestad and Jackson recorded the TVBC 2.26*108. TVBS of (Taameya) sandwiches the TVBC ranged from 6.0*105 cfu/g to 3.43*107 cfu/g. Samples obtained from Jackson recorded the highest TVBC 3.43*107. TVBS of (Shawerma) sandwiches The TVBC ranged from 1.32*105 cfu/g to 1.91*107 cfu/g. Samples obtained from Jackson recorded the highest TVBC 1.91*107. The result explained that all levels of TVBC bacteria highest of level acceptable by Sudanese standard metrology Organization (SSMO) (Pathogenic bacteria). The high bacteria load in the investigated sample might be caused by contamination from environmental, lack of personal hygiene and lack of sanitation. The study found food which presented in the Al Souq Al Arabi market not suitable for consumption (Hatim *et al* 2017).

Recent research was done by Isara *et al* to evaluated food health and safety practices on mobile food vendors in Benin City Nigeria the study was explained the very high level of knowledge of food hygiene and safety and poor safety practices. Addition all contamination of food revered to unhealthy practices of

food handling by mobile handlers. The study required more studies on evaluating microbiological quality and safety of street foods presented in Benin City. (Isara *et al*, 2019).

1.5. Food contamination:

Contamination is an important health problem affecting kids in the early edge, most pollution caused by unhealthy practices and food storage. (Eshraga, 2013).

According to the Australian International of Food Safety (AIFS), Food was contaminated with another substance; physical, biological or chemical.

1.5.1 Biological contamination:

Food corrupted with organisms or substances produced by humans, insects, rodents, and microorganisms. Food poisoning caused by some species of bacteria like E Coli, salmonella, listeria….etc and norovirus. Washing hands and sanitizing the food handling equipment were two of the best ways to prevent bacterial contamination (AIFS).

Depending on the nature of the food and preserved environment foods were substrates for undesirable microbial growth which caused them to deteriorated and spoil. Spoilage microorganisms found in or on food change palatability of foods while others lead to food poisoning if contaminated food is consumed in a sufficient quantity. In general, foodborne disease caused by bacteria, molds, and yeasts; their presence depends on appropriate nutrient substrates, sufficient water, suitable temperature, PH, and presence or absence of oxygen. However, contaminated foods were pathogenic to humans and constituted the hazard of food poisoning which involves intoxication caused by the ingestion of toxins and illness resulting from microbial infection via the intestinal tract. The risk often depends on the susceptibility of individual consumers, the pathogen and the sufficient dose (Schroder, 2003).

1.5.2 Physical contamination

Food contaminated with foreign objects such as steel, wool, Band-Aids or pieces of plastic at any production process. Foreign bodies can cause injury when inadvertently consumed. In addition to that foreign objects can be carrying biological contamination (AIFS).

Pests, birds, and insects can obtain access to food and act as disease carriers or cause physical damage (Ahmed, 2015).

1.5.3 Chemical contamination:

Food that contaminated by natural or artificial chemical substances, some of this substance can be dangerous, some time they are fatal also can contaminated food in any stage of the food process whether of pesticides transferred from the soil the food was grown in or during the manufacturing process(AIFS).

Preserve chemical substance separating from food essential to protected agents chemical contamination (AIFS).

1.6. Foodborne diseases:

Defined as Diseases of infection or toxic nature caused by or through to be caused by consumption of food or water (WHO).

The global incidence of foodborne-disease is difficult to estimate, but it has been reported that in the year 2000 alone 2.1 million people died from diarrheal diseases. Unsafe food causes many acute and life-long diseases, ranging from diarrheal diseases to various forms of cancer (WHO, 2011).

WHO estimated that foodborne and waterborne diarrheal diseases taken together killed about 2.2 million people annually, 1.9 million of them were children (WHO, 2011).

According to WHO Food, borne diseases were an important cause of morbidity and mortality worldwide with significant public health impact. The global burden of foodborne diseases in 2010 was 33 million Healthy life years lost (DALY) with about 600 million foodborne illnesses and 420,000 deaths, of which foodborne diarrheal diseases, the most frequent cause of foodborne illnesses contributed about 230,000 deaths. The burden of foodborne diseases was borne by individuals of all ages, particularly children under the age of 5 years who constitute about 40 percent of the global burden and also by individuals living in low-income regions. With considerable regional differences in the global burden of foodborne diseases, Africa stands out, as having the highest-burden per population of foodborne diseases (WHO, 2015).

“Food poisoning cast the USA $152 billion, killed 5.000 people, and sends 325.000 to the hospital each year. Around 600 million-or almost 1in 10 people in the world - fall ill after consuming contaminated food. Of these 420.000 people

die, including 125.000 children under the age of 5, finds WHO report Estimates of the Global Burden of Foodborne" (Abdelrazig et al 2017).

Khalid Eltigani study described pathogens can enter the food chain at different steps, are highly versatile and can confirm to the environment allowing survival, growth and production of toxic compounds and therefore study recommended to reduction food borne-diseases the implementation of safe food handling practices and protection from high-risk choice throughout the complete farm-to-plate continuum with the home food preparer being the last link in this chain and ensuring washing hands with soap and water before preparing food which decreased the risk of foodborne illnesses (Khalid, 2016)

Hands should be washed with soap and warm water for at least 20 seconds before and after handling food, especially raw meat. Critical control points preventing food-borne illness involved preventing cross-contamination from the raw products to ready-to-eat, using adequate times and temperatures for cooking, avoiding recontamination after cooking by surfaces previously contaminated with the raw meat and properly chilling and storing meat after cooking. Defeat to completely recognize the symptoms or sources of foodborne disease prevents the consumer from taking corrective action, and when consumers mishandle food during preparation, the health community, food industry, regulators, and the media were ultimately responsible. Whether unsuitable temperature control, poor hygiene, or another factor, the error occurs because consumers have not been informed about how to handle food and protected them and the food safety message had not been delivered effectively The FAO estimated that as much as 70 percent of diarrheal diseases in developing countries were believed to be of foodborne origin also The World Health Organization (WHO) recognizes that foodborne illness involved a wide spectrum of illnesses which were a growing public health problem worldwide and are a major contributor to illness compromised nutritional status, less resistance to disease and loss of productivity. Although acute gastrointestinal diseases are not all foodborne and foodborne diseases do not always result in acute gastroenteritis, does food represent an important vehicle for pathogens causing acute gastroenteritis (Khalid, 2016).

1.6.1 Staphylococcus aureus

It is Gram positive Cocci-non sporing, motile and capsulated. It is formed circular, smooth, shiny surface and often pigmented (golden-yellow) in Ajar medium. It presents in the nose of 30% of healthy people and may be found on the skin. It has tow type of toxins: Enterotoxins type A-E, G.H.I.J. an ingestion of microgram amount of toxin can induce the symptoms of nausea, vomiting, and diarrhea and

toxic shock syndrome toxin (TSST-1). Staphylococcus disseminated in pus and dried infected wound, burns, infected skin lesions, sputum and cough from lung of patients with bronchopneumonia. The body of human being and animals are the main reservoir. Acquisition of infection may be exogenous from external source or endogenous from patients own body. Hand washing is important in preventing the spread of the disease (Greenwood *et al.*, 2007).

1.6.2 Salmonella

Salmonellosis it has been increased within the past 20 years on many continents Investigations of salmonella outbreaks revealed that it is emergence attributed to contact with birds and eating different foods of animal origin particularly meat, pork, poultry, dairy product and eggs from hens whose ovaries are infected by the organism (Potter *et al.*, 1997). Salmonella can also lead to reactive arthritis, serious infections and deaths. The largest outbreak occurs in Chicago area in 1985, involved over 16.000 laboratory-confirmed cases out of 200.000 cases (Shays, 1996).

1.6.3 Escherichia

Escherichia is a genus of family Enterobacteriaceae. It s described as a coliform of the intestinal tract of man and other animals from which it might be found in soil, water and many other places in nature. E. coli and Aeroactor Aerogens are known as Gram-negative, short rods, lactose fermenter. E. coli was reported as the most important entero-pathogenic coliform and differentiated from A. aerogenes by IMVIC reaction. This common lactose fermenting faecal genus shown to have serotypes pathogenic for humans. They are frequently reported in the literature and are known as entero-pathogenic E. coli (EPEC). Certain serotypes of E. coli produce food-borne disease (Ahmed, 2015; FAO, 1997).

1.6.4 Bacillus cereus

It is positive Bacillus, motile and lacks the glutamic acid capsule, found on soil, water, and vegetation. It is formed large, grey and irregular colonies. It has been associated with food poisoning and found in raw foods such as rice. It has tow type of food poisoning, the first is vomiting form which occurring within six hours of ingestion. The second is diarrheal form of food poisoning which occurring within

8-24 hours after ingestion similar to enteritis caused by E.coli and salmonella. Proper cooling and good storage of foods would prevent food poisoning caused by Bacillus cereus (Greenwood *et al.,* 2007).

1.6.5. Streptococcus species

Streptococcus is a genus in the family Streptococaceae. Some species were reported to be associated with the upper respiratory tract of man and other animals causing scarlet fever and septic sore thorax (Ahmed, 2015). Others were in the intestinal tract of man and animals. They were described as Gram-positive, catalase-negative cocci producing small colonies within the mesophilic and psychrophilic (Ahmed, 2015).
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1.7. Microbial Safety of Restaurants Food

A lack of knowledge among Restaurants food about the causes of food-borne disease is a major risk factor (Ahmed, 2015). Poor hygiene, inadequate access to potable water supply and garbage disposal, and unsanitary environmental conditions such as proximity to sewers and garbage dumps further exacerbate the public health risks associated with Restaurants food (Ahmed, 2015). Traditional processing methods that are used in preparation, inappropriate holding temperatures and poor personal hygiene of food handlers are some of the main causes of contamination of Restaurants food (Barro *et al.,* 2006). Recent studies have indicated that ready to eat foods and food preparation surfaces may be reservoirs for microbial contamination (Elwathig, 2015). Street foods in some African countries have been tested for various microorganisms of public health concern, including feacal coliforms, Escherichia coli, Staphylococcus aureus, Salmonella species and Bacillus cereus (Elwathig, 2015). Escherichia coli and Staphylococcus aureus were recovered in a significant proportion of the food, water, hand and surface swabs tested in Harare, Zimbambwe (Ahmed, 2015). Street foods can alsobe sources of several groups of enteropathogens (Elwathig, 2015).

1.8. Epidemiological importance of microbial foodborne disease in Restaurants foods.

Despite the availability of food safety strategies for public health and economic development in many countries, food safety policies, plan of action and legislation have not been implemented especially in developing countries (Elwathig, 2015). In recent times, food safety issues have assumed a wider dimension because of the reliance on fast food whose preparation the consumer has no control over. In the busy way of life today, people eat more meals outside their homes. In developing countries a large portion of ready to eat is sold on the Restaurants. If this food is

not handled hygienically or not stored at the right temperature, food borne illnesses are bound to occur (Elwathig, 2015).All age groups consume Resturants food in Africa (Ahmed, 2015). However, there may be differences in the type of client depending on locality Elwathig, 2015). While it is often thought that children under five years of age are fed at home, (Elwathig, 2015) observed that many mothers working at the markets in Accra also bought some food items from Resturants to feed their babies. This has serious implications on the health of the children (Ahmed, 2015). cited documented outbreaks of illnesses in humans associated with the consumption of Restaurants foods.

1.9. Prevention and control of foodborne diseases

Treatment is not available for many infections for foodborne diseases, thus prevention efforts may be more effective and required at all levels of the food chain. The observation that combines subtyping methods, cluster identification, and collaborative epidemiologic investigation can halt the dispersed of Outbreaks. Further, outbreak investigation and case-control studies of sporadic cases can identify sources of infection and guide to prevention strategies, as well as identifying animal reservoirs is critical to the prevention of food-borne diseases (Tauxe, 1997). Concepts of food safety developed by WHO and FAO helping governments to elaborate guidance for street food production, vending and consumption, producers and vendors, training about HACCP and global view on safe street-vended food production. Control of foodborne diseases may be achieved through the application of the following: 1- cook food thoroughly at required temperature, 2- eat cooked foods immediately (within 30 minutes), 3- store cooked foods carefully (below 7ċ or above 63ċ, 4- reheat cooked foods thorough once to above 63ċ, 5- avoid contact between raw foods and cooked foods, 6- wash hands repeatedly e.g. after touching raw foods, contaminated surfaces, money and body, 7- keep all kitchen surfaces meticulously clean, 8- protect foods from insects, rodents and other animals, and 9- use safe water (Ahmed, 2015).

1.10. Knowledge, Attitudes, and Practices (KAP) on food safety and foodborne diseases:

According to Khalid Eltigani (2016) in the study to assessed KAP food Safety among workers at the Federal Ministry of Animal Resources in Sudan, food safety experts had identified the most common food safety handling mistakes made by customers at home. These mistakes involved; presented contaminated raw food, cooking or heating inadequately, obtaining food from unsafe sources, cooling food inadequately, more than hours between cooking or preparation and consumption and “having a colonized person handle implicated food or practices poor hygiene”. The same factors were identified in mishandling related to specific pathogens, so

the authors recommended that emphasis should continue on improving knowledge and control of food-borne diseases amongst food handlers, these involved the conception that unsafe food was a personal health threat, the conception that one can do something about the threat (self-efficacy), and the motivation to maintain good health. So recent studies pinpointing to training and education of food handlers in public hygiene measures and revealed a general lack of knowledge of microbiological food hazards, refrigerator temperature ranges, cross-contamination, and personal hygiene should be needed (Khalid, 216).

A study to assessed knowledge, attitudes, and behavior concerning food-borne diseases and food safety issues among formal food handlers carried out in Italy found that the majority of food handlers who had attended a training course had the knowledge and a positive attitude toward food-borne diseases control and preventive measures. They had a negative attitude when asked about self-reported behaviors and when observed during food preparation for the practice of hygienic principles. On other hand considering food-handling personnel played important role in ensuring food safety throughout the chain of food production and storage, although there are also many gaps in food safety knowledge and practices that might result in Foodborne diseases (Islam, 2014).

1.11. Importance of Education of Food Industry workers in Hygiene Issue

Educational materials mustn't be effective if they were designed without looking at the worksite social, physical, and consumer environmental factors surrounding the target consumer. Food safety education is most likely to be effective when it was designed specifically for the consumers and the particular hazard of interest (Khalid, 2016).

So requires a re-examination of food safety educational messages to conform epidemiological changing of food-borne illnesses and the increase in knowledge concerning emerging food-borne pathogens to ensure that the guidance given to consumers is adequate for controlling pathogens that were prevalent in the food supply chain (jevsnik *et al*, 2008).

Also, research is needed to establish reliable and valid evaluation measures for five behavioral constructs which are to practice personal hygiene, cook foods adequately, avoid cross-contamination, keep foods at safe temperatures, and avoid food from unsafe sources. If evaluation instruments focus on these five behavior areas, the result will be more easily summarized across food safety education programs for consumers (Lydia *et al*, 2001).

In the end, the best ways to manage the risk of food-borne illness to promoted safer handling of food at the consumer end of the food chain are communication and consumer education (Patil *et al* 2005).

Education of food industry workers in hygiene issues is recommended for improving safer food handling practices (Tracy 2011).

Media presentations can motivate people to listen and change behavior because consumers needed to understand how to protect themselves through the kitchen and personal hygiene, involving thoroughness and frequency of hand washing, temperature control, and safe food choices such as foods processed by heat or energy pasteurization (Bruhn, 1997).

Educational material regarding Good Housekeeping Practice should be available to the general public from many sources. Only safety-conscious consumers can become active partners within the food safety circle (Jevsnik *et al*, 2008).

1.12. Routine medical examinations:

According to WHO in many countries vendors are subjected to periodic screening tests prior to working as food vendors. The examinations test may include: medical history can be done by short questionnaire focus on food safety issues, the physical examination which focuses on lesions on the exposed skin surface, and throat swabs for the presence of streptococci (Ahmed, 2015).

Neither blood tests nor x-ray for tuberculosis is required because there is no evidence that any sexual disease and tuberculosis can be transmitted by foods (Ahmed, 2015).

1.13. Training of food handles:

Basic training on food safety and food hygiene for Restaurant food workers was perceived to be so important particularly before licensing. At all events very few vendors gained their knowledge of food handling by formal training (Omemu and Aderouju, 2008). The training courses often conducted by governments or recognized institutions, and it needs for collaboration among health authorities, municipalities and community. The selection of trainees should base on their interests, ability and education; the course should be designed to suit the education. Training materials should be developed to provide information about food handling practices and hazards association with street foods in specific society to make vendors aware of their responsibilities to consumers, able to judge potential hazards and able to take corrective action. Furthermore, training will enhance knowledge about the value of disease surveillance and epidemiological information in food safety program. However, information gathered from conducting HACCP such as identifying critical practices, critical points, and corrective action could be included in training programs (FAO, 1997).

1.14. Common problems face Restaurants food

Common problems face Restaurant foods include 1)improper food handling practices and poor sanitation in sites, 2) lack of knowledge on good manufacturing practices and vendors unwillingness to adopt proper sanitation techniques, 3) inadequate technologies to prepare, store and distribute food, 4) there is no training program and it is high cost to train personnel, 5) and different opinions regarding the safety, no standards among countries and limited skilled personnel (*Caribbean Regional working group on Restaurants food, 2002*).

Chapter two

Material & Methods

2.1. Study area and target population:

The study was conducted in El uozozab - Administrative unit El shegara – Khartoum locality - south of Khartoum city. Respondents were overall Street vendors i.e. school cafeterias and, fast food restaurants, food kiosks, roadside food sellers (include women inside and outside school) and food hawkers.

2.2. Study design:

Face-to-face questionnaire was used to collect information about knowledge, attitudes and practices of the target respondents regarding food safety. Questionnaire was designed to obtain information on demographics of respondents, food safety perceptions, and awareness of food-borne illnesses, contaminants of foods and hazards, sources of food safety information, confidence in food safety authorities, food handling and safety practices.

2.3. Data collection:

One hundred seventy responders were selected randomly to be interviewed by filling the questionnaire which was conducted during December 2018–January 2019.

2.3 Sample Size

A total of 6 samples of ready to eat meals from different sellers (Tagalia, Taameya, Foul, damaha, Roob and Kesra) were collected randomly from the above mentioned area.

2.4 Equipments

Glass ware, graduated cylinder, conical flasks, pipettes, Benzene flam, cotton, icebox, alcohol, scissor, spoon, hot air oven, incubator, refrigerator, autoclave, sensitive balance, test tubes, Petri dishes, racks and markers, agar medium, distilled water, were used.

2.5 Samples collection

6 samples were collected in sterile plastic containers from selling points at El ouzozab. Samples were collected and keep it in sterile ice box provided and transferee immediately to the laboratory for microbiological analysis.

2.6 Glasses ware sterilization

We used the oven to sterilize the pipettes, scissor in 180 co for two hours, and the autoclave to sterilize the glasses ware, distilled water, and the media in pressure of 15 bounds for 15 mined.

2.7 Plate count agar:

Five grams of casein enzyme hydrolysis, 2.59 of yeast extract, 1g of dextrose and 9g agar were dissolved in 1000 ml distilled water. After that the medium was boiled to blend the media and the reconstituted medium was adjusted to pH 7. Then it was sterilized by autoclaving at 15 pound per square inch pressure (121ºc) for 15 minutes.

2.8 Bacteriological method:

2.9 Preparation of the sample:

The samples were homogenized in sterile mortar and put in sterile tubes.

2.10 Preparation of serial dilutions:

Separate sterile pipettes were used, decimal dilution of 10-2, 10-3, 10-4, 10-5 and others were prepared, and sample was homogenized by transferring 1ml of previous dilutions to 9ml of diluents. Samples foam avoided, all dilution were sacked 25 times within 7seconds. 1ml of each dilution was piped into separate duplicate, appropriately marked Petri dishes. Two plates were inoculated per dilution 15-20 ml plate count agars were added (after cooled to 45ºc ±1) to each plate within 15 min. of original dilution

2.11. Data analysis:

The Descriptive statistical analysis (frequency test) for the respondents was done by using Statistical Package for Social Sciences (SPSS version 20) programme to calculate the percentage for different answers in order to identify the knowledge, attitude and practices of respondents and their concerns about food safety, and graphs was done by using Microsoft Office Excel (Office 10) programme.

Chapter three

Result

One hundred seventy questionnaires were face to face interview were completely and correctly filled with a response rate of 100%.

3.1. Sociodemographic Characteristics:

Close to half of the respondents (45%) were between the ages of 21 and 40 years old with the majority of them, female (60%), haven't school education (44%), (84.1%) were Stationary, (58.8%) haven't health certificate, (41%) their experience in vender were less than 5 years and (97.1%) were knew the food preparation from their observation.

Table (3.1) **Sociodemographic Characteristics**

Variable	Category	Frequency	(%)
Age(years)	10-20	19	11.2
	21-30	39	22.9
	31-40	38	22.4
	>40	74	43.5
Gender	Male	68	40
	Female	102	60
Educational Level	Tertiary	24	14.1
	Secondary	12	7.1
	Primary	54	31.8
	College	5	2.9
	None	75	44.1
Marital Status	Married	104	64.2
	Separated	14	8.2
	Single	52	30.6
Type of food vendor	Mobil	25	14.7
	Stationary	143	84.1
	Both of them	2	1.2
Health Certificate	With	70	41.2
	Without	100	58.8

Length of time spent vender/ year	< 5 6 – 10 11 – 20 > 20	70 42 46 12	41.2 24.7 27.1 7.1
Acquisition of knowledge of food preparation	Through observation Formal Others	165 4 1	97.1 2.3 .6

3.2 Respondents Knowledge of Food Hygiene:

Almost two thirds of the participants had heard of food hygiene (64%) indicating that their main sources of information were from television (28%), health workers (9%) and radio (24%). Almost one fifth of the respondents (19.1%) knew that diarrheal diseases were food borne and among those aware of food hygiene, there quarter (75%) knew that lack of good food hygiene practice could cause disease.

Table (3.2) Respondents Knowledge of Food Hygiene

Variable	Category	Frequency	(%)
Hearing of food hygiene	Yes No	109 61	64.1 35.9
Source of information about food hygiene	Television Health workers Radio Others Television & Radio	47 16 41 33 12	27.6 9.4 24.1 19.4 7.1
Lack of good food hygiene as a cause of disease	Yes No Don't know	127 6 37	74.7 3.5 21.8
Food borne diseases	Diarrhea Typhoid Malaria HIV Others	33 6 20 1 9	19.4 3.5 11.8 .6 5.3

	Diarrhea & malaria	24	14.1
	Diarrhea,	13	7.6
	Malaria &	6	3.5
	Typhoid	21	12.4
	Typhoid & Malaria	3	1.8
		1	.6
	Diarrhea & Typhoid	2	1.2
	Diarrhea & Others	1	.6
	Malaria & HIV	26	15.3
		2	1.2
	Diarrhea,	1	.6
	Malaria, Typhoid & HIV	1	.6
	Diarrhea, Malaria, Typhoid & Others		
	Don't know		
	Diarrhea & HIV		
	Malaria &Others		
	Diarrhea, Typhoid & Others		
Need for regular medical check-up	Yes	42	24.7
	No	128	75.3

3.3. Attitude of Respondents towards Food Hygiene:

Most of the participants (92.5%) believed that food hygiene is important but only about half of the participants (54%) were satisfied with their surrounding environmental conditions from where they provide food to the

public. When buying food, more than hahf of the respondents (57%) believed that quality of the food being bought should be their most important consideration. Even though, most of the respondents believed in hand washing (93%), a higher proportion, majority of respondents believed that the water used in washing utensils change after each use, (18%) should only be discarded when the water changes color.

Table (3.3) Attitude of Respondents towards Food Hygiene:

Variable	Category	Frequency	(%)
Believing in the importance of food hygiene	Yes	158	92.9
	No	2	1.2
	Don't know	10	5.9
Satisfaction with surrounding environmental conditions	Yes	88	51.8
	No	44	25.9
	Don't know	38	22.3
Most important belief when considering buying food	Freshness	40	23.5
	Price	31	18.2
	Quality	97	57.1
	Other	1	.6
	Quality & Price	1	.6
Believing in hand washing	Yes	158	92.9
	No	2	1.2
	Don't know	10	5.9
Time you believe that water used in washing utensils should be disposed	After each use	107	63
	Water color change	132	18.2
	Water finishing	14	8.8
	Others	17	10

3.4. Food hygiene practices and service provided

72% of the respondents use cold water and soap when washing their hands, after which they dry with a towel. While preparing and serving food, most of the respondents (91%) didn't wear apron and cap and more than half of the respondents (54%) rinse the plate with water twice after use. A majority of the respondents (81%) did not go for an initial medical exam before

commencing the food vending service and of those who went, and only (35%) went for periodic medical examination. Furthermore, a majority of the respondents (97%) did not undergo any training on food hygiene, while about (36%) of the respondents were visited at one time or the other by an environmental health worker.

Table (3.4) Food hygiene practices and service provided

Variable	Category	Frequency	(%)
Practices Hand washing methods	Cold water /soap/towel dry Cold water/cloth dry Hot water/soap/towel dry Cold water/shake hands	124 16 2 28	72.9 9.4 1.2 16.5
Wearing of apron and cap while preparing and serving food	Yes No	16 154	9.4 90.6
Frequency of rinsing plates	Once Twice Don't rinse Others	52 92 3 23	30.6 54.1 1.8 13.5
Medical exam before starting food vending	Yes No	38 138	18.8 81.2
Periodic medical exam	Yes No	60 110	35.3 64.7
Services provided Training on food hygiene	Yes No	5 168	2.9 97.1
Environmental health worker check	Yes No	59 111	34.7 65.3

3.5. **Observational Check List of Personal/Environmental Hygiene of Respondents**

On inspection of personal hygiene of the respondents, more than two third of them were neatly dressed (71%) and did not use hair coloring (88%), the respondents had well-kept nails (68%), not use an apron while preparing food (95%). On further inspection of the surrounding environment, it was observed that a majority of the respondents protected both prepared (54%) and stored (57%) food from flies and rodents and did not place uncooked food on the floor unprotected (89%). It was also observed that a majority of respondents hadn't clean wash hand basin with soap and towel (98%) with adequate supply of water (58%) and at the same time maintaining a clean service table and surrounding (52%) though, majority of the respondents (83%) hadn't inadequate sanitary conditions with most of the respondents (80%) having evidence of disease vectors in their premises.

Table (3.5) Observational Check List of Personal/Environmental Hygiene of Respondents

Variable	Category	Frequency	(%)
Personal hygiene Neatly dressed	Yes No	122 48	71.8 28.2
Well-kept finger nails	Yes No	116 54	68.2 31.8
Use of apron	Yes No	9 161	5.3 94.7
Use of hair coloring	Yes No	20 150	11.8 88.2
Environmental hygiene Prepared food protected from flies and rodents	Yes No	91 79	53.5 46.5
Stored food protected from flies and rodents	Yes No	96 74	56.5 43.5
Presence of clean wash hand basin/soap/towel	Yes No	4 166	2.4 97.6

Clean service table and surrounding	Yes No	88 82	51.8 48.2
Evidence of disease vectors in premises	Yes No	136 36	80 20
Uncooked food items placed on bare floor	Yes No	19 151	11.2 88.8
Adequate supply of water	Yes No	98 72	57.6 42.4
Adequate sanitary conditions	Yes No	29 141	17.1 82.9

3.6 laboratory inspection:

Sample taken from ready to eat meals shows that result of isolation is negative no pathogenic bacteria (staph, E coli, and salmonella).

3.7 Viable Bacterial Cell Count

Serial dilutions were used, plating and counting of live bacteria to determine the number of bacteria in a given population was used.

Table (3.6)**Viable Bacterial Cell Count**

No	Sample	*4-	*5-
1	Tagalia	27	8
2	Roob	49	15
3	Dammah	53	21
4	Kesra	19	8
5	Taameya	59	29
6	Foul	32	19

Dilution: *(104- 105-) cfu\g

Chapter Four
Discussion

This study assessed the knowledge, attitude and the level of practice of food hygiene among food vendors in El uozozab - Administrative unit al shegara – Khartoum locality - south of Khartoum city; and overall, it revealed that knowledge, attitude and training were significantly associated with the level of food hygienic practice of food vendors.

In the present study, the respondents were mainly within the ages of 21 – 40 years old (45%), This was similar to findings of studies conducted among food handlers in Sudan, Nigeria, Slovenia and Malaysia (Eshraga, 2013;Chukuezi, 2010; Jevsnik et al., 2008; Zain et al., 2002; Nee et al.,2011). This similarity indicated that majority of the food handlers were middle aged people. In this study there were more female (60%) food vendors than males which is similar to findings of other studies in Nigeria (Anthony et al 2017; Chukuezi, 2010; Smith et al., 2010; Musa et al, (2003) and contrary to a Sudanese study by Abdelrazig, et al (2017) majority of respondents were male (70%) . More of the respondents were married (62.2%) which is similar to the findings of studies conducted among food handlers in Malaysia and Sudan (Zain et al., 2002; Abdalla et al., (2008). With the difficult, harsh economic environment especially in developing countries, food vending business is rapidly expanding in the urban areas and serving as a common, accessible and complementing source of family income and employment especially for women, which is probably due to the existing cultural orientation and gender bias. The lower level of education observed among these food vendors may be attributed to the increasing number of women engaging in self-employment activities like the food vending service as a source of livelihood. Educational level in present study showed that close to half (44%) illiterate (can't read or write), similar to anther Sudanese study curried out by (Eshraga,(2013) majority of respondents (85%) were illiterate contrary to the findings of studies done in Turkey and Bangkok (Chukuezi, 2010; Murat et al., 2006; Cuprasittrut et al., 2011). The study majority respondents (97.1%) of the food vendors did not have formal education disagree with study conducted in Jos, Plateau State, North Central Nigeria, only (1.1%) had no formal education (Tolulope et al 2015). More of the respondents in this study had been working as food vendors for more than 5 years which is at variance from findings from studies conducted in Malaysia and Sudan reporting that most of the food handlers had been working for a

period of less than 5 years (Zain et al., 2002; Abdalla et al., 2008). It was observed that knowledge of the food vendors with regard to food hygiene was good for a majority of the respondents in the present study, and this observation was similar to Sudanese study by Abdalla et al, 2008) and some other studies done in Nigeria (Afolaranmi et al, 2015; Bamidele, 2015; Out, S.S. 2014). But on the contrary, studies from Ethiopia, Malaysia, Iran, Korea and Thailand observed that a majority of the food vendors had poor level of food hygiene knowledge (Tessema et al, 2014; Rahman et al, 2012; Pirsaheb et al., 2010; Park et al, 2010; Zain et al, 2002; Cuprasittrut et al, (2011). It is tempting to say that the level of good knowledge among the majority of food vendors in the present study could be related to the fact that a more than half of the respondents had literacy (56%) could have formed the basis for increased comprehension of food hygiene information and therefore improved knowledge.

Majority (88.5%) of respondents in this study had not attended any food safety and hygiene training prior to this study which is similar to 62.5%, 79.3% and 78.2% of the respondents in Malaysian, Thailand and Ethiopian studies who had not attended any food safety training (Zain et al., 2002; Cuprasittrut et al., 2011; Kibret et al., 2012). On the other hand, a majority of the respondents did not do the required initial medical examination before commencing the food vending business (81%) and also of those that did, just a few (35%) of the respondents subsequently went for periodic medical examinations. Probably the lack of awareness, additional costs or associated inconveniences, especially when they feel healthy, may have contributed to why the majority of the respondents did not do medical examinations. Though, Abdussalam et al. and Kaferstein, (1993) is of the opinion that medical examination of food vendors prior to commencement or at periodic intervals thereafter, should not be mandatory, because it does not significantly ensure food safety. Notwithstanding, there is always a possibility of food vendors, being healthy carriers of disease and infecting consumers and as such, it is in the best interest of the consumer that all food vendors be examined.

On further analysis, it was revealed that the level of knowledge, attitude and formal training were significantly associated with food hygienic practices of the respondents. This was consistent with a number of studies; in Malaysia by Rahman et al, (2012) where knowledge, attitude and training were significantly associated with practice, in Nigeria by Afolaranmi et al .2015,

where knowledge and training were significantly associated with practice, in Ethiopia and Thailand by Tessema et al. 2014, and Cuprasittrut et al.2011) respectively, where both studies reported that, knowledge was significantly associated with practice. On the contrary, a study in Nigeria by Out S, 2014) reported that attitude was not significantly associated with practice and also a study in Ghana by Rheinlander et al. 2008), reported that knowledge was not closely related to practice and this was attributed to the existing socio-cultural context which probably had a greater influence on safe food practices.

In the present study, formal training on food hygiene practices appear to be very low with only 3% of the respondents having received training, and this appears to be a problem across developing countries as studies from Nigeria, Ethiopia, Malaysia and Thailand have reported a range of only between 12% - 39% of food vendors having received training on food hygiene practices Musa et al, 2003; Afolaranmi et al, 2015; Zain et al,2002; Cuprasittrut et al, 2011; Nigusse et al, 2012; Omemu et al, 20008; Kibret and Abere, (2012). Formal training of food vendors is important in ensuring good personal and environmental hygiene and has been reported by Monney et al,203) who showed that, food vendors trained on food hygiene and safety are more likely to keep their finger nails clean and adequately protect their food from flies and dust. Despite the low level of formal training in the present study, the observational check list on hygiene standard, showed that while close to three quarters of respondents were neatly dressed, only about half of the respondents had well- kept finger nails. Also while about 53% of respondents protected their food from flies and rodents, only a few (17%) had adequate sanitary conditions. So in the present study, the level of personal and environmental hygiene appears to be fairly good, and therefore similar with some other studies Martins, (2006); Von and Makhoane, (2006) whose authors have argued that, due to the food vendor's necessity to depend on the customer's repeat patronage in order to maintain and sustain their livelihood, the vendors are more likely inclined to produce relatively safe food by maintaining the minimum required level of hygiene standards; even though a serious gap still exists for the improvement of proper hygienic conditions and access to basic sanitary facilities for the food vendors.

Conclusion & Recommendation

With rapidly increasing number of food vendors especially in the urban areas and their access to a rapidly growing consumer base, there is a need for increased vigilance and control of the food vendor's practices through the enforcement of regulations, proper hygienic practices and food safety control measures by local authorities that are empowered to perform their functions without constraints, with the aim of preventing and controlling the potential risks and spread of disease. The purpose of this study was to examine food safety knowledge attitude and practices by interviewing 170 vendors and also assessment of bacteriological profile of street ready – to eat meals and detect factor that contributing food contamination by taken samples from different site to assessment bacteriological contamination. The research has demonstrated that most street vendors in this study do not have adequate food safety knowledge on topics of health and personal hygiene such as hands washing and preventing cross-contamination. In addition to that they have also inadequate knowledge on microbial hazards and disease transmission. This lack of knowledge leads them to improper hygienic practices which place consumers at increase risk of contracting food-borne diseases. Isolation was negative no pathogenic bacteria (Salmonella, Staphylococcus, and E. coli) maybe samples were taken from cooked meals. In conclusion street food vendors must have better knowledge of food safety concepts and need to receive more information about food handling practices to enable them to translate knowledge in to practice.

Recommendations

Recommended that:

-Governmental policies and protocols regarding food vendors subsequent enforcement (including the provision of resources) need to be addressed as a matter of urgency through Localities.

- Formal training on hygienic practices, initial medical and periodic medical certification and regular personal and environmental hygiene checks.

- Close supervision of street foods in food safety and hygiene including sampling assessment and conducting HACCP must be done by relative authorities, as well as enhancing sanitation and basic infrastructure in vending

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بسم الله الرحمن الرحيم

Appendix

Sudan University of Sciences and Technology
Supervisor
Prof . Mohammed Abdelsalam Abdalla
Knowledge, Attitude and Practices of Food
Hygiene among Street Food Vendors in (Elouzuzab) South Khartoum
By
Ann Mutsaim Karamalla
(Questionnaire)

Note
: This questionnaire is designed for a survey on the Vendors knowledge, Attitude and Practices of food safety and factor which contribute contamination of food. The data will be collected for study purposes only.

Sociodemographic characteristics

1-Age (years)	( ) 10 - 20 ( ) 21 - 30 ( ) 31 - 40 ( ) >40
2- Gender	( ) Male ( ) Female
3- Educational level	( )Tertiary ( ) Secondary ( ) Primary ( ) None
4- Marital status	( ) Married ( ) Single ( ) Separated
5- Residence	
6- Type of food vender	( ) Mobil ( ) Stationary
7- Health certificate	( ) With ( ) Without
8- Length of time spent ven**ding (year)**	( ) < 5 ( ) 6-10 ( ) 11-20 ( ) >20
10- Acquisition of knowledge of food preparation	( ) Through observation ( ) formal ( ) Others
11- Type foods vended	( ) (Soup (vegetable soup, plain soup, etc.) ( ) Porridge ( ) bread ( ) Bean ( ) Snacks ( ) Meat(chicken and beet) ( ) Others
12- Drinks	( ) Bottled soft drink ( ) Fresh juice ( ) Others

Knowledge of Venders on food hygiene

13- Have you heard of Food Hygiene	( ) Yes ( ) No
14- Source of information about Food Hygiene	( )Television ( ) Health workers( ) Radio ( ) Others
15- Lack of good food hygiene as a cause of disease	( ) Yes ( ) No ( ) Don't know
16- Food borne diseases	( ) Diarrhea ( ) Typhoid ( ) Malaria ( ) HIV ( ) Others
18- Need for regular Medical check-up	( ) Yes ( ) No

Attitude of Venders towards food hygiene.

19- Do you believe in the importance of Food Hygiene	( ) Yes ( ) No ( ) Don't know
20- Are you satisfied with surrounding environmental conditions	( ) Yes ( ) No ( ) Don't know
21- Most important belief when considering buying food	( ) Freshness ( ) Price ( ) Quality ( ) Others
22- Do you believe in hand washing	( ) Yes ( ) No ( ) Don't know
23- When do you believe that water, used in washing utensils should be disposed	( ) After each use ( ) Water color change ( ) Water finishes ( ) Other

Food hygienic practices and services provided.

Practices

24- Hand washing methods	( ) Cold water/Soap/towel dry ( ) Cold water/cloth dry ( ) Hot water/Soap/towel dry ( ) Cold water/Shake hands ( ) Hot water/cloth dry ( ) Hot water/Soap/Shake hands
25-Wears apron and cap while preparing and serving food	( ) Yes ( ) No
26- Frequency of Rinsing plates	( ) Once ( ) Twice ( ) Don't rinse ( ) Others
26- Medical exam before Starting food vending	( ) Yes ( ) No
27-Periodic medical exam	( ) Yes ( ) No

Services provided

28- Training on food hygiene	( ) Yes ( ) No
29-Environmental Health worker Check	( ) Yes ( )No

Observational Check List of Personal / Environmental Hygiene of Respondents

Personal Hygiene

30- Neatly dressed	( ) Yes	( )No
31- Well-kept finger nails	( ) Yes	( )No
32- Use of apron	( ) Yes	( )No
33- Use of hair coloring	( ) Yes	( )No

Environmental Hygiene

34- Prepared food protected from flies and rodents	( ) Yes	( )No
35-Stored food protected from flies and rodents	( ) Yes	( )No
36- Presence of clean wash hand basin/soap/towel	( ) Yes	( )No
37- Clean service table and surrounding	( ) Yes	( )No
38- Evidence of disease vectors in premises	( ) Yes	( )No
39- Uncooked food items placed on bare floor	( ) Yes	( )No
40- Adequate supply of water	( ) Yes	( )No
41- Adequate sanitary conditions	( ) Yes	( )No