



**Sudan University of Sciences and Technology
College of Graduates Studies**



Assessment of Knowledge, Attitudes and Practices of Consumers in Bahri Locality, Khartoum State Regarding Food Safety

**تقييم معرفة ومواقف وممارسات المستهلكين في محلية بحري ولاية الخرطوم
بشأن سلامة الغذاء**

**A thesis submitted to the Collage of Graduate Studies in fulfillment of
requirements for the Master in Preventive Veterinary Medicine [Food Safety]**

By:

Layla Abdalkhalig Altaib Siralkhatim

BVM, 2008

Supervisor:

Professor. Mohammed Abdalsalam Abdalla

**Department of Preventive Veterinary Medicine and Public Health, Collage of Veterinary
Medicine, SudanUniversity of Science and Technology.**

2022

Dedication

This work is dedicated to my father and my mother (may Allah give them all needs and health), My brothers (Khalid, Abdulla, Mohammed and Altaib), My sisters (Rehab and Shatha), My husband (Mahmoud) and to my sons and daughters who bring much joy to my life (Mohammed, Manasik, Maiada, Mattab and Hussam).

Acknowledgments

I would like to pay all praise and thanks to Almighty Allah the most gracious and most merciful who granted me the mind, health, strength and patience to conduct this study.

I wish to express my deepest gratitude to my supervisor Prof: **Mohammed Abdalsalam Abdalla** for encouraging me and easing the way through a research.

I appreciate all those helping me during my research (Musa, Ola, Mohammed Babiker. M.H, Ibrahim, Shinnawi, Hana and Salma).

Abstract

Food borne illnesses are prevalent in all parts of the world. This study was conducted in August 2016 in Bahri locality, Khartoum state, to evaluate the knowledge, attitudes and practices of the consumers regard food safety. Questionnaire guided face to face interview with 120 respondents were carried out. Major food safety knowledge concepts include clean and hygiene, general sanitation, safe storage of food, proper cooking of food, use of thermometer in cooking. The results of the questionnaire showed that the most of the respondents know the importance of washing hands before handling food (63%) and also washing the instruments and cleaning of the counter just after the preparation of the meal (83%). The results of the questionnaire revealed that (50%) of the respondents know the importance of covering hands with a bandage and gloves when their hands were cut during preparations of food. About (80%) of the respondents didn't know the proper way of thawing, and (84.2%) of them didn't know food thermometer which use to ensuring proper cooking. In general, the respondents had good knowledge about some food safety related issues and not enough knowledge about other issues. This study recommend for Consumers should know and apply the five keys to safer food and implementing more training programs to the consumers to improve knowledge, attitudes and practices towards food safety.

المستخلص

الأمراض المنقولة عن طريق الغذاء في ازدياد في كل أجزاء العالم. تمت هذه الدراسة في شهر أغسطس 2016 في محلية بحري ولاية الخرطوم لتقييم مستوى المعرفة والسلوك والتطبيق لدى المستهلك في مجال سلامة الغذاء. تم عمل الاستبيان بالمقابلة الشخصية مع 120 شخص. معظم المفاهيم المعرفية المتعلقة بسلامة الغذاء تضمنت النظافة العامة، نظافة الأيدي والأدوات، نظافة المكان، الطبخ بالصورة المثلى واستخدام جهاز قياس درجة حرارة الطعام في الطبخ. أظهرت نتائج الاستبيان إن معظم الفئة قيد الدراسة يعرفون أهمية غسل الأيدي قبل أعداد الطعام (63%) وغسل الأدوات المستخدمة وتنظيف مكان أعداد الطعام بعد الانتهاء من تجهيز الطعام مباشرة (83%)، أيضاً أظهرت نتائج الاستبيان أن (50%) من الفئة قيد الدراسة يعرفون أهمية تغطية الأيدي التي بها جرح أثناء أعداد الطعام. كما أظهرت الدراسة أن (80%) من الفئة قيد الدراسة لا يعرفون الطريقة الصحيحة لتذويب الطعام المجمد و(84%) لا يعرفون جهاز قياس حرارة الطعام. عموماً كان لدى الفئة قيد الدراسة مستوى معرفة جيد ببعض القضايا المتعلقة بسلامة الغذاء بينما بعضهم ليس لديهم المعرفة الكافية ببعض القضايا المتعلقة بسلامة الغذاء. توصي هذه الدراسة المستهلكين بضرورة معرفة وتطبيق المفاتيح الخمسة لسلامة الأغذية وتنفيذ المزيد من برامج التدريب للمستهلكين لتحسين المعرفة والسلوك والممارسات تجاه سلامة الأغذية.

List of Contents

Item	Page No
Dedication	I
Acknowledgements	II
Abstract	III
المستخلص	IV
List of contents	V
List of tables	VI
List of Abbreviations	VII
Introduction	1-4
Chapter one Literature review	
1.1 Definitions	5
1.2 Knowledge	5
1.3 Attitudes	5-6
1.4 Practices	6
1.5 Good Hygiene Practices(GHP)	6
1.6 Frozen food	6
1.7 Food safety	7
1.8 Hazard	7
1.9 High risk food	7
1.10 Micro-organisms	7
1.11 Sanitizers of food contact surfaces	7-8
1.12 Storage food	8-10
Chapter tow Materials and Methods	
2.1 Study area	11
2.2. Methodology	11
Chapter three Results	
3. Results	12-17
Chapter four Discussion	
4. Discussion	18-20
Conclusion and Recommendation	21
References	22-27
Appendix	28-30

List of tables

No	Title	Page No
3.1.	Demographic characteristics of the respondents [n=120]in Bahri locality Khartoum State	12
3.2.	Handling and storage before preparation by respondents [n=120]in Bahri locality Khartoum State	13
3.3.	Practices of hygiene by the respondents [n=120]in Bahri locality Khartoum State	14
3.4.	General behavior of the respondents [n=120] in the kitchen in Bahri locality Khartoum State	15
3.5.	The knowledge of respondents [n=120]about food safety in Bahri locality Khartoum State	16

List of abbreviations

CDC:	Center and Prevention.
Codex Alimentarius:	A joint FAO and WHO commission established in 1961 responsible for implementing food Standards and programs.
EU:	European Union.
FAO:	Food And Agriculture Organization.
GHP :	Good Hygienic Practices.
FSA:	Food Standards Agency (UK).
HACCP:	Hazard Analysis critical Control Point System.
KAP:	Knowledge, Attitudes and Practices.
USA:	United States of America.
WHO:	World Health Organization

Introduction

Food is basic human need and the major source of nutrients needed for human existence, so the consumers demands fresh, tasty healthy and wholesome food products. Nevertheless, safety is in this frame work considered an absolute requirement; placing unsafe food on the market is not an option in the consumer's mind (Arie *et al* 2010). Food choice is often influenced more by psychological interpretation of product properties than the physical properties of product themselves and food quality has been an important factor (Rozin *et al* 1986). Consumers often use their sense in their descriptions of safe food, and feel that food that looks or smells bad should not eaten.

Consumers need to make informed choices about their food and how it is handled and prepared. Considerable amount of food preparation handling and storage take place in the domestic environment, especially at our homes, so by understanding the behaviors of the consumers and assuring the education of the consumers regarding the risk of unsafe food-handling practices is an essential element of the prevention of food –borne diseases (Surujlal and Badrie ,2004).

Food safety has emerged as an important global issue with international trade and public health implications. In less developed and developing countries, the food safety issues are increasing day by day due to various factors like the increase in the age of human populations, unplanned urbanization, migration and mass production of food due to population growth and changed food habits (Kafenstein and Abdussalam,1999).

If the consumers are not taking healthy and safe food then there will be probability of more number of cases of food borne diseases. When they will be ill, then these patients will invest to cure themselves. If the food which will be available to them is safe then there will be fewer chances of food borne diseases.

People around the world become diseased from the food they consume. This illness is known as food-borne illness and is caused by harmful microorganisms and /or toxic chemicals (WHO ,2006).

Food borne illnesses occur due to eating contaminated food or drink. Large numbers of microbes and substances may contaminated foods. There are more than 250 known food borne illnesses, and most of them are infectious and are occur due to bacteria, viruses and parasites. Foodborne illness has more impact on health and economy in developing countries than in developed countries but answering data is not available. According to the World Health Organization the global incidence of illness is difficult to estimate, but it has been reported in 2005 alone 1.8 million persons died from diarrheal diseases. Contaminated food leads to 1.5 billion cases of diarrhea in children annually, resulting in more than three million premature deaths (WHO, 2010). Food borne illnesses have lead to a significant morbidity and mortality all over the world. The United- State of America reports that about 76 million foodborne illnesses occur yearly with 325,000 people hospitalized and 5200 cases of mortality (Buzby and Roberts, 2009). WHO reports that 18% of children aged less than 5 years old in developing countries die resulting of diarrhea world- wide (Bryce, 2005).

Also the centers for diseases control and prevention (CDC, 1996) explain that, the out breaks of food- borne illnesses which resulted from foods of animal sources had leads to about 76 million illness, 325,000 hospitalizations and 5000 deaths annually.

Food borne disease is highly dangerous and even life- threatening to some consumers, particularly children, elderly, pregnant women and those have immune deficiency or allergies. Food borne illness out breaks are common in South Africa, but are seldom reported (Smith *et al*, 2007). Food safety is not an operator, which effects the public's selection when opting a eating foundation (Leach *et al*,2001).

Food selection is often effected more by psychological explanation of overcome themselves (Rozin *et al*,1986) and food quality have been consequential operator (Lewis,1981).

Consumer often use their meet beaten in their blazons of safe food, and notifiesthat food smells or looks bad should not be consumed (Seward, 2003). They cannot apprise the hazard of sustaining a food –borne disease at the time of buy or eating of food stuff because they cannot be noticed the rang of microbial contamination or the level of chemical remnants (Roberts *et al*, 2003). Consumers need to industrializes informed selections around their food and how it is handled and accounted. It is well-known that botches subjective and ambient hygiene contribute substantially to food contamination and resultant food-borne disease (Mathee *et al*,1996; Bryan, Michanie, Alvarez and Paniaywa, 1988).

In one deliberating food handlers were characterized as the major reason of foodimpureness (Campos et al, 2009). Hand washing has been conceded as an necessaryingredient in the prevention of the diffusion of microbial contagiousness (Fendler, Dolan, and Williams,1998). If food handlers disregard the prominence of washing hand during food preparation, some bacteria like *Escherichia-coli*, *staphylococcus aureus* can be present on the hands of food handlers (Lues and Tonder,2007). With the presence of this bacteria, the hands of food handlers can be played as carrier to disseminates noxious microorganisms through cross contamination (Bas *et al*, 2006).

Ehiri *et al*, (1996), pointed out that, knowledge himself is not adequate corroboration positive attitudes and safe behaviors between food handlers as well asknowledge, attitudes is also a consequential factor that ensures lowering destinationof food borne illness. Howes *et al*, (1996), indicates the engagement of positive behavior, attitudes and sustainable education of food handlers toward the fending of safe food handling practices.

The objectives of current study were: to describe the demographic characteristic of the respondents, and to assess the knowledge, attitudes and practices of respondents toward meat regarding food safety and hygiene in Bahri- locality.

CHAPTER ONE
LITERATURE REVIEW

CHAPTER ONE

LITERATURE REVIEW

1. Definitions

1.2 Knowledge

Knowledge is a familiarity awareness or understanding of someone or something such as facts, information, description or skills which is acquired through experience or education, perceiving, discovering learning. Knowledge accumulates through learning processes and these may be formal or informal instruction, personal experience and experiential sharing (Tracy, 2011). It has been traditionally assumed that knowledge is automatically translated into behavior. Knowledge however is not insignificant and it is found to be vital in the cognitive processing of information in the attitude- behavior relationships. There is direct relationship between knowledge and behavior. In health related studies, however, it has been found that knowledge is not the only factor that influences treatment seeking practice and in order to change behavior, health programs need to address a number of issues including socio-cultural, environmental, economical and structural factors (Tracy, 2011). Behaviorists further add that a number of factors can influence one or more of the KAP variables such as self-esteem, self-efficacy and misconception (Glanz *et al* 2002 and Keller, 2007).

1.3 Attitudes

This is a manner, disposition, feeling, position with regard to persons or thing. Tendency or orientation especial for mind. It is also expression of favor or disfavor toward person, place, things or event. Attitude involves evaluative concepts associated with the way people think, feel and behave (Keller, 2007). It comprises a cognitive, emotional and a behavioral component implying what you know, how you feel and

what you do (Keller, 2007). The diversity among consumers is based on a variety of factors, including demographics and socio-economic status.

Wilcock *et al.* (2004) indicated that different attitudes do not necessarily lead to behaviors that increase the safety of the food consumed and specific attitudes may suggest a specific behavior when taken in isolation, but this may not be the case when considering the broader purchase decision (Vermeir *et al.*, 2006). Additional attitudes come into play, moderating behavior, attenuating the influence of principled attitude, and resulting in substitute outcome (Vermeir and Verbeke, 2006). In 2006 the World Health Organization (WHO, 2006) introduced simpler, more generally viable and necessary food safety messages or principles associated to behaviors. If adopted and practiced, these messages will decrease the probability of foodborne illness. The core messages of the Five Keys to Safer Food are: (1) keep clean; (2) Separate raw and cooked; (3) Cook thoroughly; (4) keep food at safe temperatures; and (5) Use safe water and raw materials. On the other hand Byrd *et al.* (2007) developed a food safety knowledge into five concepts or keys inspired by WHO (2006), which are cross contamination prevention/disinfection procedures; safe times/temperatures for cooking/storing foods; groups at greatest risk for foodborne disease; foods that increase risk of foodborne disease; and foodborne disease pathogens.

1.4. Practices

Repetition of performance or systematic exercise for the purpose of acquiring skills or proficiency.

1.5. Good Hygienic Practices (GHP)

All practices regarding the condition and measures necessary to ensure the safety and suitability of food at all stages of the food chain (Codex, 2004).

1.6. Frozen food

Product maintained at a temperature equal to or below -18 °C in any part of the product (Codex, 1997).

1.7. Food safety

Food safety is an assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use (FAO/WHO, 2003). Foodborne diseases are still among the most broadly health problems in the contemporary world. In rich and poor countries both, they form considerable health burdens, ranging in severity from mild to fatal illnesses in order (Tracy, 2011)

1.8. Hazard

A biological, chemical or physical agent in food with condition of the potential to cause an adverse health effect (Codex, 2004).

1.9. High risk foods

Food is allowed growth and reproduction of bacteria, which are eaten without cooking or any other transactions to exterminate the bacteria, such as milk and milk products, eggs, meat, fish and vegetables that does not include acidic foods (with a pH less than 4.6), but also includes any food stored or prepared or handled at improper temperature (Alhmzawy, 2004).

1.10. Micro-organisms

Including yeasts, moulds, bacteria, viruses and parasites. When used as an adjective, the term “microbial” is used (Codex, 2004).

1.11. Sanitizers of food contact surfaces

Cleaning and sanitizing of food contact surfaces is one of the critical step to control cross contamination. Food contact surfaces including any surface that may come in contact with food. Food contact surface includes,

counters, tables, cutting boards, utensils, etc. Harmful microorganisms that cause food-borne illness can be transferred from contaminated food contact surfaces into food. Chemicals are routinely used to sanitize the food contact surfaces.

These chemical usually ensure that the food produced and consumed are as free from microorganisms that can cause food-borne illness. To achieve the required level of sanitization or disinfection, the chemical in question must be applied at a certain concentration for a specified amount of time (Pfundner, 2011).

1.12. Storage of food

Many studies proved that it is critical to practice self-hygiene especially hand hygiene because hand is the major agent that transmit microorganisms and intestinal parasites to foods (Aarnisalo *et al*, 2006). Also Abdalla *et al.*,(2009) considering food handling personnel play 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 may result in foodborne diseases according to (Eduarda *et al.*, 2007) . Hand washing has been shown to effectively remove micro-organisms from hands decrease the spread of food borne infections in numerous situations. In this study the food respondents that are always wash their hand in different occasions(63.3%) because organisms such as *Salmonella typhimurium*, *Campylobacter* species and *E.coli* can survive on fingertip (WHO, 2007). Food safety has outcropped as an important global issue with international trade and public health implications (WHO, 2007). Food safety issues are as old as mankind and since time immemorial humans have developed strategies to ensure that the food they eat does not harm them, and unsafe food has been a human health problem since history was first recorded, and many food safety problems

encountered today are not new. Although governments all over the world are doing their best to improve the safety of the food supply, the occurrence of food borne disease remains a significant health issue in both developed and developing countries. It has been estimated that, each year 1.8 million people die as a result of diarrheal diseases and most of these cases can be attributed to contaminated food or water. Proper food preparation can prevent most food borne diseases (WHO, 2007). Microorganisms are the root cause of quality and safety problems. All those who handle food, including farmers, food producers, individuals who work in markets and food service establishments, and other food preparers, have a responsibility to keep food as safe as possible (WHO, 2007).

HACCP is a risk management tool specifically designed for the food sector by the Codex Alimentarius Commission (Codex 2004), jointly established by the Food and Agriculture Organization (FAO, 2003) and the World Health Organization (WHO, 2003). HACCP stand alone is not effective until or unless it is not supported by GMP or pre requisite program that control the hygiene and environmental condition of food operation (Sperber, 1998).

The HACCP methodology is a structured, preventive approach to food safety that optimizes efforts to provide the consumer with safe food. It requires a food operation to have in-depth knowledge of their products and processes and to assess the potential hazards involved, their relative risk, and which are significant to end product safety. It then involves a further evaluation of each product and process to locate critical steps where each significant hazard could emerge, so that systems of constant monitoring, recording of variations, and necessary action plans can be put in place at these critical points. The entire system must be documented, validated and routinely verified (Taylor, 2010). Worldwide, it is recognized that, the application of the HACCP system to food production

and preparation has clear benefits and the potential of enhancing food safety and preventing many cases of food borne diseases (Bryan, 1988).

HACCP identifies potential hazards and faulty practices at an early stage rather than reacting to deficiencies in end-product testing. It focuses on raw material and process control rather than structure and layout of food premises (Ehiri *et al.*, 1996). A few studies have also been carried out to explore manager's attitude and understanding in food safety, HACCP and food hygiene training (Mortlock *et al.*, 1999; Taylor and Taylor, 2004a, b). The postal survey by Mortlock *et al.* (1999) in the UK showed that, most managers perceived their businesses to be low risk regardless of the foods they handle. Taylor, (2007) interviewed four small and medium enterprise owners, who were implementing HACCP, using a qualitative, in-depth, discovery-based methodology. It was found that, the main barriers that hindered HACCP implementation were due to HACCP being considered as difficult, burdensome and unnecessary and because of staff and external problems. The authors explained that the interplay of barriers at knowledge, attitude and behavioral levels could account for these problems.

CHAPTER TWO
MATERIALS AND METHODS

CHAPTER TWO

MATERIALS AND METHODS

2.1. Study area

This study was carried out in August 2016 at Bahri - locality, Khartoum State. Bahri locality is a city in Khartoum State, located 11°15.63333 N, 32.55E in the north of Khartoum city, the capital of Sudan. It is located on the north bank of the Blue Nile and the east bank of the River Nile, near the confluence of the Blue Nile with the White Nile and bridges connect it with both Khartoum to its south and Omdurman to its west. It had a population of 1,012,211 at the last Sudanese census in 2008. It is part of a three- city agglomeration (with Khartoum proper and Omdurman) with a combined population of 4,272,728 in 2008. The industrial center of the region and the country, the neighborhood contains dockyards, marine and rail workshops, and sawmills. Khartoum North trades in cotton, grains, fruits, and livestock, industries include tanning, brewing, brickmaking, textile weaving, and food processing.

2.2. Methodology

Data was collected through questionnaire and face to face interviews with the respondents. A questionnaire has been developed to check the food safety knowledge, attitudes and practice. The relationship among consumers concerns and knowledge on food safety will be determined by using a face to face conversation questionnaire. Level of consumers knowledge about food safety selected according to Beck and Garden (2010) and by the concepts set by Byrd *et al*, (2007) and also according to the five keys to safer food which are mentioned by WHO (2010). A total of 120 consumers will be interviewed face to face in Bahri- locality. Questionnaire will be designed to obtain informations on food safety perception and awareness of food- borne illnesses, contamination of food and hazards, food handling and safety practices at homes.

CHAPTER THREE

RESULTS

CHAPTER THREE

RESULTS

In this study, a majority (87.5 %) of consumers were found to be females while the rest (12.5%) were males (Table 3.1). 56.7% were found to be in age 20-40 and the highest percentage of 41.7% for university education.

Table 3.1: Demographic characteristics of the respondents [n=120] in Bahri Locality Khartoum State

Characteristics	Numbers	Percent
Age (years)		
< 20	7	5.8
20_40	68	56.7
> 40	45	37.5
Gender		
Male	15	12.5
Female	105	87.5
Education Level		
Elementary	27	22.5
High school	43	35.8
University	50	41.7

Table 3.2: Handling and storage before preparation by respondents [n=120]in Bahri Locality Khartoum State

Statement	Response%			
	Always	Sometimes	Rarely	Never
I carefully check the purchase whether it is damage or not	98 (81.7)	8 (6.7)	5 (4.2)	9 (7.5)
While purchasing frozen foods, I check whether the product is really frozen or not	37 (30.8)	19 (15.8)	26(21.7)	38 (31.7)
Are you careful about keeping raw meat or fish away from ingredients that are eaten raw like salad?	103 (85.8)	6(5)	5(4.2)	6 (5)
Do you purchase food from an approved venders	13 (10.8)	27 (22.5)	26 (21.7)	54 (45)
Before any food is prepared, the safety of the food is assessed by the food looks and smells	100 (83.3)	6 (5)	3 (2.5)	11(9.2)
Store fresh produce in the refrigerator above raw meat or Poultry	12 (10)	3(2.5)	4 (3.3)	101 (84.2)
Expiration date	52 (43.3)	59 (49.2)	4 (3.3)	5 (4.2)

Table (3.2) showed that majority of consumers (81.7%) were always carefully checked the purchase whether it damaging or not, while 4.2% were rarely. The highest percentage of consumers (31.7%) were never check whether the product is really frozen or not while 15.8% were sometimes check the purchase whether it frozen or not.

About 85.8% of consumers were careful about keeping raw meat or fish away from ingredients that were eaten raw like salad, while 4.2% were rarely careful about keeping raw meat or fish away from ingredients that were eaten raw like salad.

The consumers (45%) were never purchase food from an approved venders, while 10.8% always do it. The majority of the consumers (83.3%) were found to assess the safety of the food before preparation by looking and smelling, while 2.5% of them rarely assessed the safety of the food.

About 84.2% were never store fresh product in the refrigerator above raw meat or poultry, while 2.5% were sometimes stored fresh product in the refrigerator above raw meat or poultry.

Table 3.3: Practices of hygiene by the respondents [n=120]in Bahri Locality, Khartoum State

Statement	Response%			
	Always	Sometimes	Rarely	Never
Do you wash your hands before you handle food?	76 (63.3)	13 (10.8)	18 (15)	13 (10.8)
Do you use hand sanitizer?	8(6.7)	8(6.7)	13(10.8)	88(73.3)
Is your food areas are cleaned with hot water and soap?	25 (20.8)	25(20.8)	33 (27.5)	37(30.8)
Do you wash the utensils and clean the counter just after the preparation of the meal?	99(82.5)	13(10.3)	4(3.3)	4(3.3)
To check the spoilage of the food in refrigerator from 2-3 days ago , I taste them	40(33.3)	10(8.3)	13(10.8)	57(47.5)
Do you cover your hands with a bandage and glove when you prepares food with cuts on your hands?	60(50)	10(8.3)	14(11.7)	36(30)

As shown in table 3.3 the highest percentage of the respondents (63.3%) were found always wash their hands before they were handle food. Most of the respondents (73.3%) were never use hand sanitizer, but (6.7%) of them were sometimes and always use hand sanitizer.

About 30.8% of the consumers were never clean food areas with hot water and soap 20.8% of them were always and sometimes. About 82.5% of the consumers were always washing the utensils and cleaning the counter just after the preparation of the meal while 3.3% of them were rarely and never washing the utensils and cleaning the counter just after the preparation of the meal . The consumers (47.5%) were never check the spoilage of the food in refrigerator from 2-3 days ago by taste the food, while 8.3% were sometimes do it .The consumers were always (50%) cover their hands with a bandage and gloves when they prepare food with cuts on their hands, 8.3% were sometimes cover their hands with a bandage and gloves when they prepare food with cuts on their hands .

Table 3.4. General behavior of the respondents [n=120] in the kitchen in Bahri locality, Khartoum State

Statement	Agree	Disagree	No idea
Left over:			
Divided them into small portions put into refrigerator	73 (60.8)	47 (39.2)	0
Put them into larger container	50 (41.7)	70 (58.3)	0
You have no left problem	39 (32.5)	81 (67.5)	0
Thawing:			
In refrigerator conditions	32 (19.2)	97 (80.8)	0
Put the frozen food in a nylon bag and immerse in hot water	40 (33.3)	80 (66.7)	0
Put the frozen food just on the counter	91 (75.8)	29 (24.2)	0
Keeping cooked meat at room temperature for 4-5 hours	76 (63.3)	43 (35.8)	0
Raw and cooked foods should be stored separately to reduce the risk of food contamination	113 (94.2)	7 (5.8)	0
Cooked meat can be left at room temperature over night to cool before refrigerating	61(50.8)	59 (49.2)	0

Table (3.4) showed 60.8% of the consumers were agreed to divide left over into small portions and put into refrigerator while 39.2% were disagree, 41.7% agree to put them into larger container while 58.3% were disagree and 32.5% have no left over problem while 67.5% have left over problem. But 80.8% of the consumers were disagreed of thawing in refrigerator conditions, while 19.2% agree of thawing in refrigerator conditions. Also 66.7% disagree to put the frozen food in nylon and immerse in hot water, while 33.3% agreed to put the frozen food in nylon and immerse in hot water. About 75.8% agree to put the frozen food just on the counter, while 24.2% disagree to put the frozen food just on the counter .About 63.3% of the consumers agreed to keep cooked meat at room temperature for 4-5 hours, and 35.8% disagreed to keeping cooked meat at room temperature for 4-5 hours. 94.2% agree to store raw and cooked foods separately to reduce the risk of food contamination, while 5.8% disagree to store raw and cooked foods separately to reduce the risk of food contamination.50.8% of the consumers agree to leave cooked meat at room temperature over night to cool before refrigerating, and 49.2% disagree to left cooked meat at room temperature over night to cool before refrigerating.

Table 3.5. The knowledge of respondents [n=120] about food safety in Bahri locality Khartoum State

<i>Statements</i>	Correct	Incorrect	Don` t know
Refrigerating food only slows bacterial growth	58 (48.3)	13 (10.8)	45 (37.5)
Proper cooking includes meat cooked at 40°c	18 (15)	16 (13.3)	86 (71.7)
Cooked meat can be left at room temperature over night to cool before refrigerating	40 (33.3)	67 (55.8)	10 (8.3)
Meat thermometer are useful for ensuring food is cooked Thoroughly	13 (10.8)	5 (4.2)	101 (84.2)
Well-cooked foods are free of contamination and don` t cause risk to Consumers	100 (83.3)	12 (10)	7 (5.8)
Freezing the food kills microorganisms in them	30 (25)	11 (9.2)	74 (61.7)
Raw meat is a great risk for the consumer	86 (71.7)	22 (18.3)	12 (10)
Using same equipment for both raw and cooked foods no cause food safety risks to consumers	25 (20.8)	70 (58.3)	24 (20)
Raw food should be kept separately from cooked food	108 (90)	8 (6.7)	4 (3.3)
Improper storage of food may be hazardous to health	104 (86.7)	6 (5)	10 (8.3)
We should Consume low fat foods	95 (79.2)	17 (14.2)	8 (6.7)
Limit my fresh vegetables and fruits consumption	40 (33.3)	53 (44.2)	27 (22.5)
Limit my poultry meat consumption	100 (83.3)	20 (16,7)	0
Limit my fish and fishery product	109 (90.8)	11 (9.2)	0
Limit my egg consumption	25 (20,8)	95 (79,2)	0
Limit my red meat consumption	5 (4,2)	115 (95,8)	0

There were 48.3% out of 120 person answer correct,10.8% answer incorrect and 37.5% answer they did not know that refrigerating food only slows bacterial growth as shown in table 3.5.About 71.7% out of 120 person did not know proper cooking included meat cooked at 40°c, while 15% answered correct proper cooking included meat cooked at 40°c and 13.3% answered incorrect proper cooking included meats cooked at 40°c.Out of 120 person there was 55.8% answered incorrect cooked meat can be left at room temperature over night to cool before refrigerating, where as 33.3% answered correct cooked meat can be left at room temperature over night to cool before refrigerating and 8.3% do not know cooked meat can be left at room temperature over night to cool before

refrigerating. But 84.2% did not know meat thermometer were useful for ensuring food was cooked thoroughly, while 10.8% answered correctly and 4.2% answered incorrect. Out of 120 person there was 83.3% answered correct well-cooked foods are free of contamination and did not cause risk to consumers, while 10% of them answered incorrect and 5.8% answered they do not know well-cooked foods are free of contamination and did not cause risk to consumers.

About 61.7% of the consumers answered they did not know freezing the food kills microorganisms in them, 25% answered correct freezing the food kills microorganisms in them and 9.2% answered incorrect.

Out of 120 person 71.7% answered correct raw meat is a great risk for the consumers, 18.3% answered incorrect and 10% answered did not know raw meat is a great risk for the consumers.

The consumers answered incorrect using same equipment 58.3% for both raw and cooked food no cause food safety risks to consumers, and 20.8% answered correct, while 20% answered did not know using same equipment for both raw and cooked food no cause food safety risks to consumers. About 90% out of 120 person answered correct raw food should be kept separately from cooked food, and 6.7% answered incorrect, while 3.3% answer did not know raw food should be kept separately from cooked food.

The respondents (86.7%) answered correctly improper storage of food may be hazardous to health, and 8.3% did not know, and 5% answered incorrect improper storage of food may be hazardous to health. Out of 120 person there was 79.2% consumed low fat foods.

About 83.3% out of 120 person answered correct limit their poultry meat consumption, while 16.7% answered incorrect limit their poultry meat consumption. The consumers (90.8%) limited their fish and fishery products. The persons (79.25%) did not limit their egg consumption but 20.8% of them limited their egg consumption. But 95.8% of them limited their red meat consumption while 4.2% of them did not limit their red meat consumption.

CHAPTER FOUR

DISCUSSION

CHAPTER FOUR

DISCUSSION

Demographic characteristic revealed 56.7 % of the respondents between 20-40 were 37,5% > 40 were, and 5,8 were < 20 in age. 87, 5% female and 12,5% male as shown in table (3.1). As reflected by the study it was clear that, the educational level of the respondents was (22.5%) elementary, (35.8%) had high school, and 41,7 had university education table (3.1).

The study revealed many critical features about the knowledge and practice of the respondents, table (3.2), almost 83.3% of the consumers have well knowledge and practice to assessed the safety of the food before any food is prepared, by the food looks and smells. In agreement with the finding of Antoria, (2002) that significant proportion of epidemiological diseases occurs due to unhygienic handling and poor food sanitation in restaurants, kitchens and other eating outlets, in the present study most of the respondents 73.3% were never use hand sanitizer.

In this study table(3.3), 63.3% of the respondents were always washing hands before starting food preparation and 50% were always wearing gloves during food preparation and they sure this procedures reduce the risk of food contamination, these finding resemble the results of Ko W.H.(2011), Rosnani *et al* .(2014) found out that the broad majority of the restaurants employees of Fu-Jen University in China believe that hands washing before touching food and wearing gloves for processing uncooked foods can reduce the risk of contamination. While Rosnani *et al* . (2014) pointed out to that touching food with bare hands is an awful practice with an average score of 78.9 ± 25.611 as thought by restaurant workers in Putrajaya, Malaysia.

The most important hygienic measure is cleaning of the working area. In this study table (3.3), 82.5% of the respondents were always wash the utensils and clean the counter just after the preparation of the meal and they sure that proper cleaning and handling of food preparation instruments decrease the hazard of food contamination.

This was different from the observation of Ko W.H. (2011) who observed that only equal or less than four point scales in respond to the following questions: when you washed the dishes you would use the three sink method, and if there were cracks on the dishes you would still use them, and you did not need to clean the drainage every day.

In the present study table(3.3), 30%, 11.7%, 8.3% of the respondents were never, rarely and sometimes respectively, cover their hands with a bandage or gloves when preparing food with cuts on their hands .The finding of the present study did not confirm the finding of the previous epidemiological studies that shown *E-coli*, *Salmonella* species and *Staphylococcus aureus* can survive on the hand for a certain period of time in case the hands were not washed or even sometimes when washed, because of that wearing gloves during food preparation is accepts to noticeably decrease the food contamination (Pether and Gilbert, 1971). In food handlers-associated food borne outbreaks, the most greatly reported way of transition involved poor hand hygiene or bare hand contact with food (Todd *et al* .2007).

Azanza and Zamora –Luna (2005) found that the knowledge and applying of the basic principles of the hygiene like washing hands during preparation of food and serving, it has lead to noticeably decreasing in the level of microbial contamination in Philippines. Van-Kampen (1998) found out that shortage of hand washers and the low level of the peoples knowledge lead to the preparation of unhealthy and hazard food in Jakarta. Rosnani *et al*, (2014) found that out 80.3% were not backing the proposing of storing raw and cooked food separately. Other common food-safety measures mentioned by Rosnani *et al*, (2014) included workers should not

rub face or hands and hair and should not smoke during working and separate kitchen instruments that were used to serve and prepare cooked and raw foods .This finding of this study did confirm the findings of Ko W.H. (2011) who found that between the questions that had the highest outcome was, raw food and cooked food must be handled separately.

The finding of the present study confirm the findings of the two previous studies Rosnani (2014) and Ko W.H. (2011), that 94.2% table(3.4), of the respondent agreed that raw and cooked foods should be stored separately to reduce the risk of food contamination .Incorrect thawing of frozen red meat, poultry and fish could lead to some food poisoning cases between the consumers (Roberts, 1982; and Abdalla, 2008a,b).This finding did confirm with the present study which found that, 33.3% (table 3.4) of the respondents were agreed, put the frozen food in a nylon bag and immerse in hot water .*Salmonella* is one of the major foodborne causes of gastroenteritis and often connected with contaminated poultry meat (Bryan and Doyle,1995). *Campylobacter* also is one of the most common bacterial causes of acute gastroenteritis in humans in advanced countries (Allos, 2001) .The finding of these studies did confirm the findings of the present study which found that(table 3.5) 71.7% of the respondents agreed that raw meat is a great risk for the consumers.

Epidemiological studies often show the wrong handling of raw poultry products or consumption of under cooked poultry products as the most likely source of exposure to *Campylobacter* (Kapperud *et al.*,1993,2003; Luber *et al.*,2006).National-scale genotyping of *Campylobacter* species in Scotland was used to quantify the relative importance of various possible sources of human infection, most clinical isolates were due to chicken meat, identifying it as the main source of *Campylobacter* infection in humans (Sheppard *et al.*, 2009). The finding of these studies was confirm the finding of the present study (table 3.5) 83.3% of the respondents answered correct well-cooked foods are free of contamination and do not cause risk to consumers.

Conclusions and Recommendations

Conclusions and Recommendations

Conclusion:

Major food safety knowledge concepts including clean and hygiene, prevention of cross contamination, general sanitation, safe storage of food and correct thawing. The responses of interviewed consumers varied considerably, in general, the respondents had good knowledge about some food safety –related issues and not enough knowledge about other issues. The results of the questionnaire showed that the majority of the respondents know the importance of washing hands before handling food and, cleaning the counter just after the preparation of the meal, and half (50%) of the respondents know the importance of covering hands with a bandage and gloves when preparing food with cuts on their hands.

Recommendations:

- This study shows that there is a need for additional researches in the area of consumers and the possible risks they may pose with regard to food safety.
- Implementing more training programs to the consumers to improve knowledge, attitudes and practices towards food safety.
- Consumers should know and apply the five keys to safer food.

References:

Aarnisalo, K., Tallavaara, K., Wirtanen, G., Maijala, R. Raaska, L. (2006), “The hygienic working practices of maintenance personnel and equipment hygiene in the Finnish food industry”. *Journal of Food Control*. 17: 1001-1011.

Abdalla MA, Siham ES, Alian YYHA, Amel OB (2008a). Microbial content of the domestic refrigerators in Khartoum area (Khartoum North). *Sud. J. Vet. Sci. Anim. Husb.* 47(1&2): 15-23.

Abdalla MA, Siham ES, Alian YYHA, Amel OB (2008b). Food safety knowledge and practice of street food-vendors in Khartoum city. *Sud.J. Vet. Sci. Anim. Husb.* 47(1&2): 126-136.

Abdalla, M. A.; Suliman, S.E. and Bakhiet. A.O. (2009), Food safety knowledge and practices of street food vendors in Atbara City (Naher Elneel State Sudan). *African Journal of Biotechnology*. Vol 8 (24), pp. 6967-6971.

Alhmzawy, L.F. (2004). Food Safety HACCP and Risk Analysis.

Allos,B.M.2001. *Campylobacter jejuni* infections: Update on emerging issues and trends. *Clin.Infect.Dis.*32:1201-1206.

Alimentarius Commission, FAO, Rome.

Antoria, M.D.A.,(2002):Brazil Institutional Experience for the Implementation of Risk Analysis on Food Safety. FAO/WHO Global forum of food safety regulations(Agenda item 4.49) G.F01/13.

Arie,H.,Havelaar;Brul,S.;Jong,R.;Marcel,H.;Beno,H.andkuile,T.(2010).Future challenges to Microbial Food Safety. *International Journal of Food Microbiology*.Vol 139, Supplement, PpS79_S94.

Azanza M.P.and Zamora-Luna,M.B. (2005): Barriers of HACCP team members to guideline adherence. *Food Control*, 16,15-22.

Bryan F.L. (1988). Risks of practices, procedures and processes that lead to out- breaks of food borne diseases. *Journal of food Protection* Clayton, D.A., Griffith, D.J .price, 1:663-673.

Bryan FL, Doyle 1995 MP. Health risks and consequences of *Salmonella* and *Campylobacter jejuni* in raw poultry .*J Food protect*; 58:326-44.

Bryan, F.L., Michanie,S., Alvarez, P.& Paniaywa, A.(1988).critical control pointsof street-vended foods . *Journal of food protection*, 51:373-383.

Bryce, J., Boschi -Pint, C., Shibuya, K., Black, R.E.,& the WHO Child Health Epidemiology References Group (2005). WHO estimates of the causes of death inchildren. *The lancet*, 365 (9465), 1147-1152.

Buzby, J.C., and Roberts, T.(2009). The economics of enteric infections: Human food borne disease costs .*Gastrointorology* , 136 (6),1851-1862.

Byrd-Bredbenner, C.; Wheatly, V.; Schaffner, D.; Bruhn, C.; Blalock, L. and Maurer, J. (2007), “Development and implementation of a food safety knowledgeinstrument”, *Journal of Food Science Education*, Vol. 6, pp. 46-55.

CDC (US Department of health and Human Services –centers for Disease Control and Prevention), (1996) .surveillance for food borne-disease out breaks: United states .Centers for Disease Control and Prevention Surveillance summary .Morbidity and Mortality .weekly Reports 45:5.

Codex Alimentarius Commission, (1997). Recommended International Code of Practice, General Principles of Food Hygiene. CAC/RCP 1-1969, Rev.3 Amended;1999.

Codex Alimentarius Commission, (2004). Recommended International Code of Practice, General Principles of Food Hygiene. CAC/RCP 1-1969, Rev.4, Amended;2003.

Eduarda Gomes-Neves; Ana, A.C; Elisabete, R. and Carla, S.C.(2007).

Food handling: Comparative analysis of general knowledge and practice in three relevant groups in Portugal. *Food control*. Vol (18).

Ehiri, J.E. and Morris, G.P. (1996). Hygiene training and education of food handlers. *Journal of Ecology Food Nutrition* 35: 243-251.

FAO/WHO, (2003). Basic Texts on Food Hygiene, Third Edition. Codex

Glanz, K., Lewis, F. M. and Rimer, B. K. (2002). *Health Behavior and Health Education: Theory Research and Practice*. San Francisco: Wiley and Sons.

Kaferstein, K. and Abdussalam, M., (1999). Food safety in the 21st century, *Bulletin of the World Health Organization*, Vol. 77 No. 4, pp. 341-51.

Kapperud, G., E. Skjerve, L.Vik, K. Hauge, A. Lysaker, I. Aalmen, S.M. Ostroff, and M.Potter, (1993). Epidemiological investigation of risk factors for *Campylobacter* colonization in Norwegian broiler flocks. *Epidemiological. Infect.* 111:245-255.

Kapperud, G., G.Espeland, E.Wahl, A.Walde, H.Herikstad, S.Gustavsen, I.Tveit, O.Natas, L.Bevanger, and A.Digranes, (2003). Factors associated with increased and decreased risk of *campylobacter* infection: A prospective case-control study in Norway. *Am.J.Epidemiol.* 158:243-242.

Keller, J. (2007). *Attitude Is Everything: Change Your Attitude...and You Change Your Life!* Book.

Ko W.H.(2011): Food Sanitation Knowledge ,Attitude, Behavior for the University Restaurant Employees. *Food and Nutrition Science*. 2,744-750.

Luber, P., S. Brynstad, D. TOPSCH, k. Scherer, and E. Bartelt, (2006). Quantification of *Campylobacter* species cross-contamination during handling of contaminated fresh chicken parts in kitchens. *Appl. Environ. Microbiol.* 72:66-70.

Mortlock, M.P.; Peters, A.C. and Griffith, C. (1999). Food hygiene and HACCP in the UK food industry, practices, perceptions and attitudes.

Journal of Food Protection 62: 786-792.

Pether JVS, Gilbert RJ (1971). The survival of Salmonellas on fingertip and transfer of the organisms to food, *J. Hyg.* 69:673-681.

Pfuntner, M.A., (2011), “*Sanitizers and Disinfectants: The Chemicals of Prevention.*” Food Safety Magazine, August/September 2011, Hartono and Company LLC.

Roberts D. (1982) Bacteria of public health significance In *Meat Microbiology*. (Edited by Brown M.H.). Applied Science Publishers Ltd. 319-386.

Rosnani A.H R.Son.O.Mohhidin ,P.S.,Toh and L.C.Chai(2014): Assessment of Knowledge, Attitudes and Practices Concerning Food Safety among Restaurant Workers in Putrajaya, Malaysia. *Food Science and Quality Management*, 32,20-27.

Rozin, P, Pelchat, M.L. and Fallon, A.E, (1986). Psychological factors influencing food choice. in: R.C. Gofton and J. Mckenzie (Eds), pp .85-106.

Sheppard, S.K., J.F.Dallas, N.J.Strachan, M.MacRae, N.D.McCarthy, D.J.Wilson, F.J.Gormley, D.Falush, I.D.Ogden, M.C.Maiden, and K.J.Forbes (2009). Campylobacter genotyping to determine the source of human infection. *Clin.infect.Dis.* 48:1072-1078.

Smith, A .M, Gouws, A, Hoyland, G, Sooka, A . & Keddy, K .H . (2007). out breaks of food –borne disease –A common occurrence but Rarely Reported. the Group for Enteric, Respiratory and Meningeal Disease surveillance in south Africa (GERM-SA). Scientific letter .[on line]. Available :<http://www.samj.org.za /index. php /samj/article/view file/272/382> [Downloaded :18/08/2011, 10:48pm].

Sperber, W.H. (1998), “Auditing and verification of food safety and HACCP”, *Food Control*, Vol. 9 Nos 2-3, pp. 157-62.

Surjulal, M.and Badrie, N. (2004). House hold consumer food safety study in Trinidad, west India. *Journal of food safety* Vol (3).

Taylor, E. (2010). Good Hygiene Practice (GHP)-Taylor Shannon International (TSI) and Sharjah Municipality

Taylor, E.A., & Taylor, J.Z. (2004a). Perceptions of the “bureaucratic nightmare” of the HACCP. A case study. *British Food Journal*, 106(1), 65-72.

Taylor, E.A., & Taylor, J.Z. (2004b). Using qualitative psychology to investigate HACCP implementation barriers. *International Journal of Environmental Health Research*, 14(1), 53-63.

Taylor, J.Z. (2007). *Understanding and managing risk: the use of in-depth psychological narrative interviews in the development and evaluation of an effective new HACCP-based system for catering businesses*, PhD thesis, University of Salford.

Todd, E. C.D., J.D. Greig, C.A. Bartleson and B.S. Michaels (2007) : Outbreaks where food workers have been implicated in the spread of food borne disease. Part 3 Factors Contributing to outbreaks and description of outbreak categories. *J. Food Proteins.*, 70, 2199-2217.

Tracy, P. (2011). Assessing the Knowledge, Attitudes and Practices of Street Food Vendors in the City of Johannesburg regarding Food Hygiene and Safety. *etd. uwc.ac.za*.

Van Kampen, J., Gross, R., and Schultink, W. (1998): The microbiological quality of street foods in Jakarta as Compared to home prepared foods and foods from tourist hotels. *Int. J. Food Sci. Nutr.*, 49, 17-26.

Vermeir, I. and Verbeke, W. (2006) Sustainable Food Consumption: Exploring the consumer “Attitude_Behavioral intention “Gap. *Journal of Agricultural and Environmental Ethics*. 19:169–194.

WHO (2010). Five keys to safer food manual.

WHO, (2006). Five Keys to Safer Food Manual Available at [http://www.who.int/food safety/ onsumer/5 keys /en/index.html](http://www.who.int/food_safety/consumer/5_keys/en/index.html).

WHO, (2007). Food safety and food borne illness. Fact sheet No. 237.

WHO, (2007). Prevention of food borne disease: Five simple measures could significantly reduce the global incidence of food borne disease. Five keys to safer food WHO Launches new "5 Keys" Strategy in Bangkok, Thailand.

Wilcock, A.; Pun, M.; Khanona, J. and Aung, M. (2004) Consumer attitudes, knowledge and behavior: a review of food safety issues. *Trends in Food Science &Technology* Vol 15(2), pp 56-66.

APPENDIX

APPENDIX

Questionnaires to determine the Knowledge, attitudes and practices of consumers towards Food Hygiene and Safety 2016.

Demographic characteristics of the respondents [n=120] in Bahri Locality Khartoum State

Characteristics	Numbers	Percent
Age (years)		
< 20		
20_40		
>40		
Gender		
Male		
Education Level		
Elementary		
High school		
University		

Handling and storage before preparation by respondents [n=120]in Bahri Locality Khartoum State

Statement	Response%			
	Always	Sometimes	Rarely	Never
I carefully check the purchase whether it is damage or not				
While purchasing frozen foods , I check whether the product is really frozen or not				
Are you careful about keeping raw meat or fish away from Ingredients that are eaten raw like salad?				
Do you purchase food from an approved venders				
Before any food is prepared , the safety of the food is assessed by the food looks and smells				
Store fresh produce in the refrigerator above raw meat or Poultry				
Expiration date				

Practices of hygiene by the respondents [n=120] in Bahri Locality ,Khartoum State

Statement	Response%			
	Always	Sometimes	Rarely	Never
Do you wash your hands before you handle food?				
Do you use hand sanitizer?				
Is your food areas are cleaned with hot water and soap?				
Do you wash the utensils and clean the counter just after the preparation of the meal?				
To check the spoilage of the food in refrigerator from 2-3 days ago , I taste them				
Do you cover your hands with a bandage and glove when you prepares food with cuts on your hands?				

General behavior of the respondents [n=120] in the kitchen in Bahri locality, Khartoum State

Statement	Agree	Disagree	No idea
Left over:			
Divided them into small portions put into refrigerator			
Put them into larger container			
You have no left problem			
Thawing:			
In refrigerator conditions			
Put the frozen food in a nylon bag and immerse in hot water			
Put the frozen food just on the counter			
Keeping cooked meat at room temperature for 4-5 hours			
Raw and cooked foods should be stored separately to reduce the risk of food contamination			
Cooked meat can be left at room temperature over night to cool before refrigerating			

The knowledge of respondents [n=120] about food safety in Bahri locality Khartoum State

<i>Statements</i>	Correct	Incorrect	Don` t know
Refrigerating food only slows bacterial growth			
Proper cooking includes meat cooked at 40°c			
Cooked meat can be left at room temperature over night to cool before refrigerating			
Meat thermometer are useful for ensuring food is cooked Thoroughly			
Well-cooked foods are free of contamination and don` t cause risk to Consumers			
Freezing the food kills microorganisms in them			
Raw meat is a great risk for the consumer			
Using same equipment for both raw and cooked foods no cause food safety risks to consumers			
Raw food should be kept separately from cooked food			
Improper storage of food may be hazardous to health			
We should Consume low fat foods			
Limit my fresh vegetables and fruits consumption			
Limit my poultry meat consumption			
Limit my fish and fishery product			
Limit my egg consumption			
Limit my red meat consumption			