

**Sudan University of Science and Technology
College of Graduate Studies**

**Assessment of Knowledge, Attitudes and
Practices of consumers in Khartoum state
regarding Food Safety**

تقويم معرفة و رؤية و ممارسات مستهلكين اللحوم في ولاية
الخرطوم بشأن سلامة الأغذية

By

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Dedication

To my mother who has always been
supportive and helpful throughout my

life. She is my thoughtful source of wisdom, inspiration and guidance.

To my small family who gave the time and support during my study.

To my sisters and friends, who supported and motivated me.

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Abstract

The aim of the present study was to determine the knowledge in the first place, attitudes and practices (KAP) of population within the state of Khartoum, with regard to food safety and find out the relationship between consumer's knowledge to food safety and numerous issues related to this topic such as "demographic characteristics of consumers, healthier lifestyle, general behaviors and thoughts with regard to food safety issues, source of information and finally the degree of responsibility of different entities regarding food safety"

The results showed that 8% had an excellent level, 44% of consumers categorized under the good level, 30% had a moderate knowledge and 18% of them did not have the awareness and knowledge about safety of the food they consume. Most of consumers who had a moderate and good knowledge about food safety were found to

be those having university education, with their age ranging from 20-40 years. Female represent 32.6%, 47.2% from those awarded good and moderate knowledge respectively.

Most of the sources of information on the opinion of consumers were television and radio, which are still, have trust from people unlike newspapers. However the results of the analysis showed that there is a direct relationship between the Internet and the level of consumers' knowledge. More over the results showed that the degree of knowledge of each individual has a strong link with his lifestyle by a way or another. Also 74.7% of consumers have expressed their responsibility to prepare a healthy and safe food for their families.

ملخص الاطروحة

كان الهدف من هذه الدراسة تحديد معرفة المستهلك المكتسبة في مجال سلامة الاغذية في المقام الاول و معرفة موقفه من سلامة الاغذية المتناولة و بعض ممارساته الصحية داخل ولاية الخرطوم، و كذلك معرفة العلاقة بين مدى معرفة المستهلك في مجال سلامة الاغذية والعديد من القضايا ذات الصلة بهذا الموضوع مثل "الخصائص الفرد الفردية ، وأسلوبه المتبع في مجال الحفاظ على الصحة ، سلوكياته العامة وأفكاره في قضايا سلامة الاغذية. و كذلك معرفة مصادر معلوماته في هذا الصدد ومن في رايه المسؤول من سلامة المنتج المستهلك .

أظهرت النتائج أن 8% كان على مستوى ممتاز من المعرفة في مجال سلامة الاغذية ، 44% من المستهلكين صنفوا تحت مستوى جيد، وكان 30% لديهم مستوى معرفة متوسط، وان 18% منهم فقط ليس لديهم الوعي والمعرفة حول سلامة الاغذية التي تستهلك. كما كان معظم المستهلكين من الذين يندرجون تحت تصنيف الدرجة الجيدة و المتوسطة من الحاصلين على مستوى التعليم الجامعي و التي تتراوح أعمارهم بين العشرين و الاربعين سنة و ان من بينهم 32.6% من الاناث تحت قائمة الحاصلين على معرفة جيدة و 47.2% من اللواتي حصلن على معرفة متوسطة.

وقد كانت معظم مصادر المعلومات في رأي المستهلكين من الاذاعة و التلفزيون، واللذان لا يزالان يملكان شعبية واسعة على الرغم من فقد بعض من مصداقيتهما على عكس الصحف. ولكن أظهرت نتائج التحليل أن الإنترنت لديه علاقة وثيقة بينه وبين مستوى المعرفة لديهم و ليس الاذاعة و التلفزيون. ، وكذلك أظهرت النتائج أن درجة معرفة كل فرد لديها علاقة قوية مع طريقة الحياة الصحية التي يتبعها بشكل او بأخر. كما أعرب 74.7% من المستهلكين مسؤوليتهم من أعداد غذاء صحي وآمن لعائلاتهم.

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Introduction

Food is a basic human need and the major source of nutrients needed for human existence, so the consumer demands fresh, tasty, healthy and wholesome food products. Nevertheless, safety is in this framework considered an absolute requirement; placing unsafe food on the market is not an option in the consumer's mind (Arie *et al* 2010). Some people consider an expensive food is more safety than other, but according to (Bektas *et al* 2011) consumers should be informed that more expensive foods and the foods which appear as higher quality with respect to certain quality aspects may not always be complying with food safety.

Unsafe food causes many acute and life-long diseases, ranging from diarrhoeal diseases to various forms of cancer. WHO (2010) estimates foodborne and waterborne diarrhoeal diseases taken together kill about 2.2 million people annually, 1.9 million of them are children. WHO defined Food safety as the degree of confidence that food will not cause sickness or harm to the consumer when it is prepared, served and eaten according to its intended use (Ususan 2007). The World Health Organization (WHO) and Food and Agriculture Organization (FAO) defined food commodity as safe when free from all hazards, which may make food injurious to the health of the consumers whether for chronic or acute consequences (lossaso *et al* .2012).

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](#)). According to Redmond *et al* (2003), [Surujlal and Badrie \(2004\)](#), behaviors of the consumers at home may be considered as a good reflection of their knowledge or at least what they believe regarding food safety. So food safety experts have identified the most common food-handling mistakes made by consumers at home. These mistakes include serving contaminated raw food, cooking or heating food inadequately, obtaining food from unsafe sources, cooling food inadequately, allowing 12 hours or more between preparation and eating, and having a colonized person handle implicated food or practice poor hygiene. The same factors were identified in mishandling associated with specific pathogens (Bruhan 1997).

According to all above there are five behavioral constructions (control food factors) or a good food handling to intervention effectiveness on food safety and to ensure reducing the risk of the most prevalent and/or serious causes of foodborne illness. These are; practice personal hygiene, cook foods adequately, avoid cross-contamination, keep foods at safe temperatures, and avoid food from unsafe sources (Lydia *et al* 2001; lossaso *et al* 2012,). Conducting researches on food safety, food-borne illnesses, food preparation practices and risks of food-borne illnesses should be taken into consideration while establishing food safety educational programs and material developments.

It is thought that consumer's behaviors and attitudes toward safe food should be taken into account in order to completely define the term "food safety" and to determine the wrong behaviors and beliefs of the consumers. Also it should be so important to educate the consumers through understanding their diverse food safety issues relevant to them ([Wilcock *et al*, 2004](#)).

Consumers generally express their concern on food safety, yet relatively only a few of them appear to be changing their food buying and consumption behaviors in view of their concern. According to [Henson and Traill \(1993\)](#), food safety is the inverse of food risk and can be expressed as the probability of not suffering some hazard from consuming a specific food. In general, consumers concern are based on several risk factors like natural contaminants (e.g. mycotoxins, heavy metals), agro-chemicals (e.g. pesticides, nitrate), veterinary drugs (e.g. antibiotics), and packaging materials. In this regard, Arie *et al.*, 2010 stated that microbial hazard differs fundamentally from chemical hazard. While chemical residues and additives typically enter the food chain at more or less predictable steps, microbes can enter at any step. On the other hand, [Brewer *et al.* \(1994\)](#) revealed that there are six important factors that dominate the consumer's behaviors and choice toward food safety. These are; chemical issues (e.g. hormones and food additives), health issues (e.g. cholesterol content and nutritional imbalance), spoilage issues (e.g. microbiological load and contaminations), food regulatory issues (e.g. food inspection and labels), deceptive practices (e.g. weight-loss diets) and ideal situations (e.g. length of time for pesticide safety assessment). These factors may change from one research to another because of the consumer profile taken into examination.

Aim:

To determine the knowledge in the first place, attitudes and practices (KAP) of population; within the state of Khartoum, with regard to food safety and hygiene and find out the relationship between consumers' knowledge to food safety and numerous issues related to this topic.

Objectives:-

1. To describe the demographic characteristics of people.
2. To describe the knowledge of people with regard to food safety and hygiene.
3. To determine the attitudes of people towards food safety and hygiene.
4. To find the relationship between the demographic characteristic of consumers and their behavior to food safety according to knowledge they have.

Chapter One

Literature review

1.1. Knowledge, Attitudes and Practices (KAP):

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-behaviour relationship. 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).

There is direct relationship between knowledge and behaviour. 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 behaviour, health programmes 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).

Consumers' attitudes have been shown to influence and predict behavior. 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, diluting the impact of initial attitudes, and resulting in an alternative outcome (Vermeir and verbeke, 2006).

In 2006 the World Health Organization (WHO) introduced simpler, more generally applicable and essential food safety messages or principles linked to behaviors. If adopted and practiced, these messages will reduce 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 hands 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.

1.2. Food borne diseases:

Contaminated food and water have been known to be sources of illness in human societies since antiquity. Foodborne diseases are still among the most widespread health problems in the contemporary world. In rich and poor countries alike, they pose substantial health burdens, ranging in severity from mild indisposition to fatal illnesses (Tracy, 2011)

Every year, foodborne outbreaks associated with consumption of contaminated foods cause millions of cases and thousands of deaths worldwide, making foodborne illness one of the most widespread public health problems in modern society (Cagri-Mehmetoglu 2009) for example many communicable diseases, including emerging zoonoses, are transmitted through food, and many other diseases, including cancers, are associated with chemicals and toxins in the food supply. This existing burden will be compounded by the effects of climate change, which is likely to increase the incidence of foodborne diseases because of the faster growth rates of microorganisms in food and water at higher temperatures, potentially resulting in higher levels of toxins or pathogens in food (WHO, 2010).

According to what Arie *et al* (2010) said microbes can enter the food chain at different steps, are highly versatile and can adapt to the environment allowing survival, growth and production of toxic compounds and therefore Cagri-Mehmetoglu, (2009) recommended to decrease foodborne illness the implementation of safe food handling practices and protection from high-risk choices throughout the entire farm-to-fork 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 decreases the risk of foodborne illnesses. The FDA recommends that hands be washed with soap and warm water for at least 20 seconds before and after handling food, especially raw meat Cagri-Mehmetoglu, (2009). Critical control points preventing food-borne illness include 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 (lossaso *et al* ,2012). Bruhn and Schutz, (1998) Failure to fully recognize the symptoms or sources of foodborne disease prevents consumers from taking corrective action, and when consumers mishandle food during preparation, the health community, food industry, regulators, and the media are ultimately responsible. Whether inappropriate temperature control, poor hygiene, or another factor, the error occurs because consumers have not been informed about how to handle food and protect them the food safety message has not been delivered effectively (Bruhan, 1997).

Although acute gastrointestinal diseases are not all foodborne and foodborne diseases do not always result in acute gastroenteritis, food does represent an important vehicle for pathogens causing acute gastroenteritis (Tracy, 2011). The FAO estimated that as much as 70% of diarrhoeal diseases in developing countries are believed to be of foodborne origin also the World Health Organization (WHO) recognizes that foodborne diseases include a wide spectrum of illnesses which are a growing public health problem worldwide and are a major contributor to illness, compromised nutritional status, less resistance to disease and loss of productivity (Tracy, 2011).

1.3. Knowledge, Attitudes and Practices (KAP) on Food Safety and Foodborne Diseases:

A study to assess knowledge, attitudes, and behavior concerning foodborne diseases and food safety issues amongst formal food handlers conducted in Italy found that the majority of food handlers who had attended a training course had knowledge and a positive attitude toward foodborne diseases control and preventive measures (Tracy 2011). The positive attitude was not supported when asked about self-reported behaviours and when observed during food preparation for practice of

hygienic principles (Tracy, 2011). On other hand (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) .

Food safety experts have identified the most common food-handling mistakes made by consumers at home. These mistakes include serving contaminated raw food, cooking or heating food inadequately, obtaining food from unsafe sources, cooling food inadequately, allowing 12 hours or more between preparation and eating, and having a colonized person handle implicated food or practice poor hygiene .The same factors were identified in mishandling associated with specific pathogens .(bruhan 1997) so the authors suggested that emphasis should continue on improving knowledge and control of foodborne diseases amongst food handlers (Angelillo *et al*, 2000),these included the perception that unsafe food is a personal health threat, the perception that one could do something about the threat (self-efficacy), and the motivation to maintain good health (Robert *et al* 1993) so recent survey studies pinpointing the need for training and education of food handlers in public hygiene measures and revealed a general lack of knowledge of microbiologic food hazards, refrigerator temperature ranges, cross contamination and personal hygiene (Bas *et al* 2006) .

1.4. Impact of Education of Food Industry Personnel in Hygiene Matters

Educational materials may not be effective if they are designed without looking at the worksite social, physical, and environmental factors surrounding the target audience. Food safety education is most likely to be effective when it is designed specifically for the audience (consumers) and the particular hazard of interest (Nieto-Montenegro *et al* 2005) so requires a re-examination of food safety educational messages to conform epidemiological changing of foodborne illnesses and the increase in knowledge concerning emerging foodborne pathogens to ensure that the guidance given to consumers is appropriate for controlling pathogens that are 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 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) because at the end of the day the best ways to manage risk of foodborne illness to promote 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 personnel in hygiene matters is recommended for improving safer food handling practices (Tracy 2011).

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

Chapter Two

Materials and methods

2.1. Study area:

Khartoum is the political capital of the Sudan. The state lies between longitudes 31.5 -34 east and latitude 15-16 north in an area about 28.165 square kilometres. It is bordered to the north and the east side by the River Nile State, to North Western by the Northern State, and to the east and south-eastern by states of Kassala, Gedaref and Gezira. According to 2008 population census, the population of Khartoum State is estimated to be about five million people. Geographically, Khartoum divides into three blocks: -

A / First block: it starts from the Mugran, i.e. the confluence of the two rivers (the blue and white niles). Being confined between them, this block extends southwards to the boundaries of the Gezira state. Administratively, it is divided into two localities, Khartoum and Gabal Owlia localities. The block includes Sundus and Soba agricultural schemes in both Gabal Owlia and Khartoum localities respectively, along with a number of livestock, poultry, and fishary projects, besides farms of vegetables and fruits and fodder production projects.

B/ Second block: it is the Northern block, which is limited between the Blue Nile and the River Nile. It includes the localities of Khartoum North and East of the Nile, where the town of Khartoum North represents a largest one of the towns of this block. In this block, there are many agricultural projects such as the Soba East and Seleit agricultural project. It also includes the largest dairy projects in the state, namely Kuku village project. The block has also the largest industrial areas of Sudan.

C / Third block: namely, the one located west of the White Nile and the River Nile and includes three localities, which are: Omdurman, Um Badda and Karari localities. However, the city of Omdurman is the largest one among them, as it is known as the historical capital of the Sudan whose history going back to the pre- Mahdia revolution era. In this block a number of archaeological, historical, religious areas, besides popular markets. The area west to Omdurman is characterized by the natural hunting in the state. (<http://www.krt.gov.sd/khartoumen.php>)

2.2. Study design:

The relationship among consumers concerns and knowledge on food safety was determined by using a face-to-face conversation questionnaire (Appendixes). Levels of people's 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 150 consumers were interviewed face-to-face in the three blocks of Khartoum State based on multistage-stage random method. A semi-structured questionnaire was administered, the maximum duration of Questionnaire was 12-15 minutes according to comprehend of respondents to questions. 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 at homes. The questionnaire was pilot tested on 10 comparable consumers for clarity and validity and necessary adjustments was done.

2.3. Data analysis:

Exploratory data analysis was done by using SPSS { **Statistical Package for the Social Sciences** } version 20 statistical software which included Simple descriptive statistical analysis which displays the frequency distribution for all 10 tables that described in questionnaire. Univariate analysis tables that used chi-square test, describe the number of people, percentage, degree of freedoms and chi-square p-value (<0.10) which explain if there is significant difference between knowledge on food safety and demographic characteristic of consumer, healthier lifestyle, source of information on food safety and the degree of responsibility of different entities regarding food safety by using confidence interval 90% among the 150 respondent people.

Chapter Three

Results

3.1. Demographic Characteristics of Consumers:

The 150 consumers interviewed were between 20 and 40 years of age. 61(40.7%) were males and 89(59.3 %) were females. And 73(48.7)% of them were married while 77(51.3%) were single. 13.3 % of these consumers were elementary school graduates, 24% were high school graduates and 62.7 % of them had an education level of university.

Table (1): Demographical characteristics of consumers:-

Variables	Frequency	Percent (%)	Cumulative Frequency (%)
Locality			
Khartoum	50	33.3	33.3
Omdurman	50	33.3	66.6
Khartoum North	50	33.3	100
Age			
>20	8	5.3	5.3
20-40	114	76	81.3
<40	28	18.7	100
Sex			
Male	61	40.7	40.3
Female	89	59.3	100
Marital status			
Married	73	48.7	48.7
Single	77	51.3	100
Education			
Elementary	20	13.3	13.3
High school	36	24	37.3
University	94	62.7	100

3.2. Knowledge of the consumers on food safety

The results showed that 8% had an excellent level, 44% of consumers were categorized under the good level, 30% had a moderate knowledge, and 18% of them did not have the awareness and knowledge about safety of the food they consumers (Table 2 and Figure 1).

Table (2): The level of Knowledge on food safety among the 150 of the people:-

Frequency	Percent	Cumulative
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			Percent
Excellent	12	8	8
Good	66	44	52
Moderate	45	30	82
Inadequate	27	18	100
Total	150	100	

Figure (1) The distribution of respondents among the knowledge categories'

3.3. The Relationship between Knowledge and demographic characteristics of consumers:

Most of consumers who had a moderate and good knowledge about food safety ranging their age between 20-40 years, their gender were female by 32.6%, 47.2% respectively and were found to be university graduates (table 3).

Table (3): Cross tabulation for Knowledge of the consumers on food safety among the demographic characteristic of consumers:-

	Inadequate 27 (18%)	Moderate 45 (30%)	Good 66 (44%)	Excellent 12 (8%)	Total 150(100%)
Locality					
Khartoum	11(7.3)	20(13.3)	18(12)	1(0.7)	50(33.3)
Omdurman	13(8.7)	9(6)	25(16.7)	3(2)	50(33.3)
Khartoum North	3(2)	16(10.7)	23(15.3)	8(5.3)	50(33.3)
Age					
>20	2(1.3)	1(0.7)	5(3.3)	0	8(5.3)
20-40	20(13.3)	29(19.3)	54(36)	11(7.3)	114(76)
<40	5(3.3)	15(10)	7(4.7)	1(0.7)	28(18.7)
Sex					
Male	16(26.2)	16(26.2)	24(39.3)	5(8.2)	61 (40.7)
Female	11(12.4)	29(32.6)	42(47.2)	7(7.9)	89 (59.3)
Marital status					
Married	17(11.3)	24(16)	27(18)	5(3.3)	73(48.7)
Single	10(6.7)	21(14)	39(26)	7(4.7)	77(51.3)
Education					
Elementary	10(6.7)	4(2.7)	5(3.3)	1(0.7)	20(13.3)
High school	10(6.7)	14(9.3)	11(7.3)	1(0.7)	36(24)
University	7(4.7)	27(18)	50(33.3)	10(6.7)	94(62.7)

University

Table (4) showing a significant difference among age, localities and education levels to awareness and knowledge about food safety by 11.95, 18.04 and 27.97 respectively for χ^2 . And p-value 0.063, 0.006 and 0.000 respectively.

Khartoum localities had same percentage 33.3% but still had high significant difference this is something considered strange and illogical results in chi-square test.

Table (4): Univariate analysis to knowledge of consumers to food safety:

Variable	People number	(%)	χ^2	Df	P-value
Locality			18.037	6	0.006
Khartoum	50	33.3			
Omdurman	50	33.3			
Khartoum North	50	33.3			
Age			11.952	6	0.063
>20	8	5.3			
20-40	114	76			
<40	28	18.7			
Sex			4.867	3	0.182
Male	61	40.7			
Female	89	59.3			
Marital status			4.426	3	0.219
Married	73	48.7			
Single	77	51.3			
Education			27.967	6	0.000
Elementary	20	13.3			
High school	36	24			
University	94	62.7			

3.4. Consumer's food safety concerns related to several foods

Table (5) below showing the top three rates illustrated the extent of high consumer confidence in most of the food such as eggs, fish and bread, as well as the highest three rates showing how their concern towards dairy products, tap water and

appetizers/snacks. Red meat and vegetables/fruits had a moderate safety than the other food by 40%, 35.3% respectively.

Table (5): Consumer's food safety concerns related to several foods among 150 people who interviewed:-

	Extremel y safe	Safe	Moderat e safe	Unsafe	No idea
Bottled water	37(24.7)	29(19.3)	37(24.7)	38(25.3)	9(6)
Raw vegetable s and fruits	36(24)	29(19.3)	53(35.3)	27(18)	5(3.3)
Dairy products	22(14.7)	40(26.7)	46(30.7)	42(28)	0
Egg	74(49.3)	36(24)	29(19.3)	9(6)	2(1.3)
Tap water	38(25.3)	18(12)	39(26)	53(35.3)	2(1.3)
Red meat	23(15.3)	34(22.7)	60(40)	32(21.3)	1(0.7)
Poultry meat	34(22.7)	42(28)	53(35.3)	21(14)	0
Fish	63(42)	42(28)	23(15.3)	18(12)	4(2.7)
Appetizer s and snacks	3(2)	18(12)	24(16)	97(64.7)	8(5.3)
Bread	44(29.3)	63(42)	21(14)	22(14.7)	0
Bakery products	30(20)	52(34.7)	47(31.3)	20(13.3)	1(0.7)

3.5. Consumer's general food safety concerns:

Most consumers had expressed their concerns about microorganism and pesticides/residues by 74% and 72.7%, respectively. Also they did not hide their fears from toxic chemicals and heavy metals and contaminations originated from laborers.

Table (6): Consumer's general food safety concerns:-

	Extremel y dangero us (%)	Dangero us (%)	Not dangero us (%)	I am not sure (%)	I have never heard about (%)	Total (%)
Microorganisms	111(74)	33(22)	1(0.7)	3(2)	2(1.3)	150(100)

Pesticides and residues	109(72.7)	37(24.7)	0	1(0.7)	3(2)	150(100)
Toxic chemicals and heavy metals	88(58.7)	23(15.3)	4(2.7)	13(8.7)	22(14.7)	150(100)
Contaminations originated from laborers	90(60)	39(26)	13(8.7)	7(4.7)	1(0.7)	150(100)

3.6. Relationship between knowledge and healthier lifestyle:

Table (7) below showed the frequency of healthier lifestyles for consumers and the extent of confidence in food and health, but to see whether there is a difference between them and the extent of knowledge of food safety (table 8) carefully demonstrates that all lifestyles health has significant difference with the knowledge of the consumer and awareness to food safety.

Table (7): Consumers' attitude for a healthier life:-

Lifestyle	Sure (%)	Have a low opinion (%)	No idea (%)
"I try to consume low fat foods"	109(72)	34(22.7)	7(4.7)
"I try to purchase safe foods free of pesticides, hormones and chemical residues"	69(46)	42(28)	39(26)
"I try to purchase packaged foods which are not contaminated with microorganisms"	75(50)	46(30.7)	29(19.3)
"I try to consume foods free of toxic chemicals and heavy metals like mercury and lead"	78(52)	20(13.3)	52(34.7)

Table (8): Chi-square table for healthier life:-

Variable	People number	(%)	χ^2	Df	P-value
“I try to consume low fat foods”	109	(72)	13.1	6	0.041
Sure	34	(22.7)			
Have a low opinion	7	(4.7)			
No idea					
“I try to purchase safe foods free of pesticides, hormones and chemical residues	69	(46)	31.4	6	0.000
Sure	42	(28)			
Have a low opinion	39	(26)			
No idea					
“I try to purchase packaged foods which are not contaminated with microorganisms”	75	(50)	24.2	6	0.000
Sure	46	(30.7)			
Have a low opinion	29	(19.3)			
No idea					
“I try to consume foods free of toxic chemicals and heavy metals like mercury and lead”	78	(52)	35.8	6	0.000
Sure	20	(13.3)			
Have a low opinion	52	(34.7)			
No idea					

3.7. Consumers' habits changes in food consumption

Most of the people as table (9) below showed did not limit their food consumption due to expensiveness except in the case of red meat by 42%.

In case of fish and fishery products, egg consumption, poultry meat consumption and vegetable/fruits consumption 45%, 64%, 42.7% and 76% of consumers respectively did not limit their consumption due to any critical reasons that mentioned in questionnaire.

Table (9) Changes in food consumption habits of the consumers:-

1.

limit my fresh vegetable and fruits consumption

	Frequency	Percent	Cumulative Percent
low quality	3	2.0	2.0
Pesticides	10	6.7	8.7
Expensive	17	11.3	20.0
Unsafe	6	4.0	24.0
I don't limit	114	76.0	100.0
Total	150	100.0	

2.

limit my poultry meat consumption

	Frequency	Percent	Cumulative Percent
poor hygienic quality	13	8.7	8.7
Expensive	32	21.3	30.0
hormone residues	22	14.7	44.7
high fat	3	2.0	46.7
antibiotic for healing	16	10.7	57.3
I don't limit	64	42.7	100.0
Total	150	100.0	

3.

limit my fish and fishery products

	Frequen cy	Perce nt	Cumulative Percent
Unsafe	1	.7	.7
unhygienic storage	21	14.0	14.7
Expensive	56	37.3	52.0
high fat	4	2.7	54.7
I don't limit	68	45.3	100.0
Total	150	100.0	

4.

limit my egg consumption

	Frequen cy	Perce nt	Cumulative Percent
high cholesterol	18	12.0	12.0
high fat	4	2.7	14.7
Expensive	18	12.0	26.7
poor hygiene	14	9.3	36.0
I don't limit	96	64.0	100.0
Total	150	100.0	

5.

purchasing bottled water

	Frequen cy	Perce nt	Cumulati ve Percent
tap water is poor	30	20.0	20.0
poor microbiologic quality	11	7.3	27.3
undrinkable report	1	.7	28.0
I don't buy BW	108	72.0	100.0
Total	150	100.0	

6.

limit my red meat consumption

Frequen cy	Perce nt	Cumulative Percent
---------------	-------------	-----------------------

Fat	14	9.3	9.3
poor hygiene	28	18.7	28.0
Expensive	63	42.0	70.0
hormone residues	1	.7	70.7
antibiotics for healing	1	.7	71.3
I don't limit	43	28.7	100.0
Total	150	100.0	

3.8. Food -borne diseases:

Consumers suffered from food-borne disease by 68% but there were no significant difference between having disease and their knowledge level about food safety (p-value 0.864).48% of them having diarrhea,56.7% stomachache,42.7% nausea ,40.7% vomiting and 16.7%fever. But there were 51% had a food-borne disease without having fever this led to a significant difference of p-value 0.044 which is less than (0.10).

3.9. General behaviors and thoughts of consumers with regard to food safety issues:

Table (10) was divided to facilitate the reading of the results by internal categories' for questions and not annex ranking in the questionnaire.

Table (10.1) General behavior of consumers :- (1)

	Always	Someti mes	Rarely	Never
I carefully check the package whether it is damaged or not	88(58.7)	37(24.7)	17(11.3)	8(5.3)
While purchasing frozen foods, I check whether the product is really frozen or not	69(46)	44(29.3)	20(13.3)	17(11.3)
Are you careful about keeping raw meat or fish away from ingredients that are eaten raw like salad?	112(74.7)	21(14)	13(8.7)	4(2.7)
Do you wash your hands before you handle food?	129(86)	14(9.3)	6(4)	1(0.7)
I wash the utensils and clean the counter just after the preparation of the meal	127(84.7)	15(10)	3(2)	5(3.3)

(2)

To check the spoilage of the foods in refrigerator from 2-3 days ago I taste them

	Frequency	Percent	Cumulative Percent
1. Generally	83	55.3	55.3
2. Sometimes	30	20.0	75.3

3.Never	37	24.7	100.0
Total	150	100.0	

**(3)
Leftover**

	Frequen cy	Perce nt	Cumulative Percent
1. I divide them into small portions and put into refrigerator	36	24.0	24.0
2. I put them into refrigerator	24	16.0	40.0
3. I put them into larger	15	10.0	50.0
4. We cook in small amounts. We have no leftover problem.	75	50.0	100.0
Total	150	100.0	

**(4)
Thawing of frozen food**

	Frequen cy	Perce nt	Cumulative Percent
1.In refrigerator conditions	45	30.0	30.0
2. In microwave oven	25	16.7	46.7
3.I put the frozen foods in a nylon bag and immerse in hot water	60	40.0	86.7
4. I do not purchase frozen foods	20	13.3	100.0
Total	150	100.0	

**(5)
Expiration date**

	Frequen cy	Perce nt	Cumulative Percent
1. I never consume foods after expiration date	127	84.7	84.7
2. I check it in the market, if so, I do not purchase	13	8.7	93.3
3.I smell or taste, if it looks fresh I consume	8	5.3	98.7
4.I consume foods after 4-7 days of the expiration date	1	.7	99.3
5.I consume foods after 2-3 days of the expiration date	1	.7	100.0
Total	150	100.0	

Table (10.2) General thoughts of consumers:-

**(1)
keeping cooked meat at room temperature for 4-5 h, do not cause food safety risks for the consumers**

Frequency Percent Cumulative Percent

1. Yes, sure	69	46.0	46.0
2. No, I do not think so	81	54.0	100.0
Total	150	100.0	

(2)

using same equipment for both raw and cooked foods do not cause food safety risks to consumers

	Frequency	Percent	Cumulative Percent
1. Yes, sure	50	33.3	33.3
2. No, I do not think so	100	66.7	100.0
Total	150	100.0	

(3)

	absolute ly agree	Agree	do not agree	absolute ly disagree	have no idea	Total
Raw meat is a great risk for the consumer	96(64)	15(10)	5(3.3)	33(22)	1(0.7)	150(100)
Rarely cooked meat is not a great risk for the consumer	31(20.7)	23(15.3)	32(21.3)	63(42)	1(0.7)	150(100)
Freezing the foods kills the microorganisms in them	29(19.3)	42(28)	36(24)	22(14.7)	21(14)	150(100)
Before replacing the hot foods into freezer, we should wait until their temperature decrease down to ambient temperature	107(71.3)	29(19.3)	5(3.3)	1(0.7)	8(5.3)	150(100)
Awaiting leftovers at room temperature before replacing into refrigerator (until cooling down) do not cause food safety risks for the consumer	91(60.7)	33(22)	12(8)	1(0.7)	13(8.7)	150(100)

Table (10.1) reveals that 86% of consumers always wash their hands before handling food and 84.7% wash the utensils and clean the counter just after the preparation of the meal but the analysis showed that there is no significant difference between the practices of these people and the knowledge they have in relation to food safety.

Consumer habits to deal with the food in the refrigerator in a number of ways, for example, to defrost frozen food, 40% of them used nylon bag and immerse in hot water and generally 55.3% of consumers check the spoilage of the foods in refrigerator from 2–3 days ago by tasting.

Due to the difficult living conditions, 50% of consumers cook in small amounts so they had not had a leftover problem. Nevertheless, 84.7% insist that do not consume food after the expiration date.

Varied consumers opinions about the risks that comes from keeping cooked meat at room temperature for 4–5 h where 46% of them were sure about that and 54%they do not .also about using same equipment for both raw and cooked foods 66.7% of them were sure about the risks. But in spite of that there is no significant difference between their opinion and the knowledge had.

64% of consumers considered raw meat a great risk for them and rarely cocked meat is not a risk by 20.7% of consumers. And for replacing the hot foods into freezer, 71.3% said we should wait until their temperature decrease down to ambient temperature and 60.7% absolutely agreed that waiting leftovers at room temperature before replacing into refrigerator (until cooling down) do not cause food safety risks for them (table 10-2). The latter has estimated highly significant difference by 0.001 which is less than 0.10 (Table 11)

Finlay, 58.7% of consumer when they shopping always check the package whether it is damaged or not and while purchasing frozen foods, they check whether the product is really frozen or not .those both habits give a significant difference estimated p-value 0.004 and 0.067 respectively. (Table 11)

3.9.3. Table (11) significant chi-square on General behaviors and thoughts of consumers against food safety issues:

frequenc X² Df p-value

I carefully check the package whether it is damaged or not	y	24.04	9	0.004
Always	88(58.7)			
Sometimes	37(24.7)			
Rarely	17(11.3)			
Never	8(5.3)			
While purchasing frozen foods, I check whether the product is really frozen or not		16.01	9	0.067
Always	69(46)			
Sometimes	44(29.3)			
Rarely	20(13.3)			
Never	17(11.3)			
Rarely cooked meat is not a great risk for the consumer		27.35	12	0.007
absolutely agree	31(20.7)			
Agree	23(15.3)			
do not agree	32(21.3)			
absolutely disagree	63(42)			
have no idea	1(0.7)			
Freezing the foods kills the microorganisms in them		36.13	12	0.000
absolutely agree	29(19.3)			
Agree	42(28)			
do not agree	36(24)			
absolutely disagree	22(14.7)			
have no idea	21(14)			
Awaiting leftovers at room temperature before replacing into refrigerator (until cooling down) do not cause food safety risks for the consumer		33.59	12	0.001
absolutely agree	91(60.7)			
Agree	33(22)			
do not agree	12(8)			
absolutely disagree	1(0.7)			
have no idea	13(8.7)			
Thawing of frozen food		17.49	9	0.041
1. In refrigerator conditions	45(30)			
2. outside refrigerator	25(16.7)			
3. I put the frozen foods in a nylon bag and immerse in hot water	60(40)			
4. I do not purchase frozen foods	20(13.3)			

3.10. Media and food safety

The results illustrated that there is high confidence in scientists and professors from universities and nutritionists and extremely reliable by 38.7% and 64.7% respectively. By contrast there is a lack of confidence in newspaper and extremely unreliable by 52%. and have also found that Television news programmers and Radio programmers' still on the list of reliable media by 56.7 and 51.3 respectively.

Table (12): Consumer's thoughts on media and food safety:-

	Extremely reliable (%)	Reliable (%)	Unreliable (%)	Extremely unreliable
Scientists and professors from universities	58(38.7)	55(36.7)	12(8)	25(16.7)
Nutritionists	97(64.7)	43(28.7)	5(3.3)	3(2)
Publications of consumer	27(18)	37(24.7)	26(17.3)	60(40)

protection associations				
Scientific journals	29(19.3)	57(38)	9(6)	55(36.7)
Magazines related to food industry	11(7.3)	48(32)	28(18.7)	63(42)
News magazine	9(6)	47(31.3)	27(18)	67(44.7)
Newspapers	4(2.7)	49(32.7)	19(12.7)	78(52)
Television news programmers	20(13.3)	85(56.7)	12(8)	33(22)
Radio programmers'	19(12.7)	77(51.3)	28(18.7)	26(17.3)
Daily news on TV	21(14)	71(47)	14(9.3)	44(29.3)
Talk shows and magazine	10(6.7)	36(24)	42(28)	62(41.3)
Websites and publications of government	15(10)	34(22.7)	38(25.3)	63(42)
Brochures of food retailers and manufacturers	8(5.3)	48(32)	44(29.3)	50(33.3)
Publications of non-governmental food-related organizations.	27(18)	48(32)	28(18.7)	47(31.3)

3.11. Source of information:

Table (13) below indicates overleaf, parents/ friend and TV have become more important sources of food safety information; but the analysis illustrate there is no significant difference between the TV and the level of their knowledge about food safety.

The chi-square analysis show that radio and internet have same percentage but the last give a highly significant difference (p-value=0.001) among those who have the large percentage. News paper is now a less important source of food safety information for Khartoum state people.

Table (13) Chi-square table of consumer's information source on food safety:-

	People (%)	X²	Df	P-value
Television		1.4	3	0.711
Yes	86(57.3)			
No	64(42.7)			
Radio		6.5	3	0.091
Yes	65(43.3)			
No	85(56.7)			
News paper		2.1	3	0.550
Yes	26(17.3)			
No	124(82.7)			
Printed educational materials		6.4	3	0.095
Yes	36(24)			
No	114(76)			

Internet		15.4	3	0.001
Yes	65(43.3)			
No	85(56.7)			
Lectures		6.0	3	0.110
Yes	29(19.3)			
No	121(80.7)			
Parents and friend		7.1	3	0.068
Yes	101(67.3)			
No	49(32.7)			

3.12. Responsibility for food safety

Table (14) Chi-square table of consumer's opinion on degree of responsibility of different entities regarding food safety:-

	People (%)	X ²	Df	P-value
Myself		4.3	3	0.2
Yes	112(74.7)			
No	38(25.3)			28
Government agencies		1.9	3	0.598
Yes	78(52)			
No	72(48)			
Farm owner's		1.6	3	0.648
Yes	48(32)			
No	102(68)			
Consumer protection association		6.6	3	0.087
Yes	56(37.3)			
No	94(62.7)			

Although 74.7% of consumers have expressed responsibility to prepare a healthy and safe food for their family .But this does not reflect the extent of their knowledge of food safety (p-value< 0.1) .also almost half of them approved the responsibility of the government agencies but there is no significant difference between it and their knowledge. But I found that there is a significant difference (p-value >0.1) between the level of knowledge they have and the responsibility of the Consumer Protection Association for the safety of their food, which is in itself a part of the government. On the other hand, 32% of consumers consider that there is also the responsibility of Farm owner's for the production of component of a healthy food and free from contamination of all kind.

Chapter Four Discussion

The purpose of this study was to determine the consumer's awareness and knowledge to food safety and the relationship between knowledge and behavior, lifestyle and attitude regarding to food safety. This approach has agreed with Robert *et al* (1993) that when food is source of threat on consumers health and safety all

actions motivate to maintain good health and they absolutely believe can do something about it and those people are more likely to engage in food safety behavior. Our results were in accordance with other researches according to considerable depot of empirical studies, demographic characteristics of consumers, with except on of gender, age and levels of education and income, influence the consumer attitudes towards food safety (Robert et al.1993;Julie, 1995;Wilcock et al., 2004 and Unusan 2007).Differences between localities were encountered that's what needs further analysis to find out the root causes and the strength of the association between their food safety knowledge.

Khartoum's consumers had high confidence in most of the food such as egg by 74%, fish 63% which is less than 90% for egg and more than 55% for fish in unusan results in 2007. They had low confidence in dairy products by 28% comparing to 55% in unusan results. A lot of people were not very or not at all confident in the safety of meat and meat products in unusan 2007 but in this study about 40% had moderate confidence for red meat in Khartoum State.

Consumers expressed major concern for microorganism and pesticide/residues by 74%, 72% respectively that is a high proportion than any other food safety issue described. Concern about bacterial contamination was ranked as a complete concern by 36%, and lead, mercury and aluminum was considered a complete concern by only 29% of respondents in Unusan 2007 but in our results the percentage was most highest by 58.7% for heavy metals attributed to large category of those who have a high proportion of good knowledge of food safety by 44% table (2).latter explanation appears clearly in results in table(6) which was showed a strong significant difference between lifestyle of consumers and their knowledge and awareness to food safety. Also appears clearly that there is a strong relationship between what the consumer concerns extent of his knowledge and the concept of food safety.

In Malawi, a study on the KAP on food hygiene of caregivers also showed a poor relation between knowledge, behavioural and sanitary practices (Tracy, 2011). Also there is disagreement between Julie (1995) and our results in that respondents knew proper food handling concepts but did not put those concepts into practice. Therefore, increasing the adoption of safe food handling practices by consumers should become an important aspect for educators in food safety educational programmes. (Julie 1995).

Consumers were asked about their source of information on food safety (table).67.3% of them learned from their parents, this is a significantly higher proportion than that recorded in the study of jevsink (2008)53.8%.

In this study consumers asked about their opinion on degree of responsibility of different entities (myself, government agencies, farmers and consumer protection association) regarding food safety, Consumers believe that they are responsible for food safety that consume by 74.7% which is higher than any entities that mentioned, however jevsink *et al* (2008) stated that consumers believe not responsible for food safety to the same degree as food handlers.

In relation to media and food safety messages, results shown high confidence in nutritionists by 64.7 % of consumers and still TV/Radio programs had reliability by 56.6% and 51.3% respectively table (12). This supports recommendations of Bruhan (1997) for the development messages with the media to be a primary activity of a food safety education program. Consumers judge a message by the credibility of the person conveying it, its appeal to their common sense, and the frequency of the message. Media presentations can motivate people to listen and change behavior. Also it is advised that national surveys should be conducted, followed by a properly designed food safety public health campaign, to enhance household food safety awareness.(Unusan 2007) On the other hands Consumer education should be the focus in order to reduce foodborne diseases. Educational material regarding Good Housekeeping Practice (GHP) should be available to the general public from many sources. Only safety-conscious consumers can become active partners within the food safety circle Jevšnik *et al* (2008)

Conclusion

This study indicates that consumers have adequate information regarding food safety principles and their attitudes to food safety can be regarded as attuned to the need to ensure safe practices in food preparation. The practices assessed in this study also indicate that households can provide food safely although attention needs to be given to some practices and regulatory compliance. Training can be regarded as essential to ensure food safety.

Recommendations

1. Regulations regarding the general hygiene of premises and the transportation of foods should be reviewed and strengthened to focus on a risk based approach.
2. Training conducted should focus on an understanding of the rationale for the behaviours as knowledge is not always translated into practices or behaviours.
3. Consumers should make use of the Five Keys to Safer Food behavioural methodology as a guide for training purposes, on principles of good hygiene practices.
4. It is recommended that the City of Khartoum regularly update the database to ensure that it reflects the current situation and not a cumulative total as is currently the case.
5. Modernization of information capturing and inspection can be done with internet based software.
6. The other limitations of the study regarding the lack of exploratory work in this area should be addressed through further studies in this area.
7. Further exploratory studies need to be undertaken to understand the reasons for satisfactory knowledge on food safety.
8. This study shows that there is a need for additional research in the area of consumer and the possible risks they may pose with regard to food safety.

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Appendixes
CODED QUESTIONNAIRE

Sudan University of Science& Technology
College of Graduate Studies
Master of Preventive Veterinary Medicine
Consumer awareness and knowledge to food safety
Khartoum State, Sudan

Note

: This questionnaire is designed for a survey on the consumer's awareness and knowledge to food safety. The data will be collected for study purposes only.

Basic Information

Date...../...../2013

Locality.....
.....

1. Demographical characteristics of consumers:-

Age

- 1.<20:
- 2.20-40:
- 3.>40:

Gender

- 1.Female:
- 2.Male:

Marital status

- 1.Married:
- 2.Single:

Education

- 1.Elementary:
- 2.High school:
- 3.College & university:

2. Consumer's food safety concerns related to several foods:-

Bottled water

1. Extremely safe
2. Safe
3. Moderately safe
4. Unsafe
5. No idea

Raw vegetables and fruits

1. Extremely safe
2. Safe
3. Moderately safe
4. Unsafe
5. No idea

Dairy products sold under market conditions

1. Extremely safe
2. Safe
3. Moderately safe
4. Unsafe
5. No idea

Egg

1. Extremely safe
2. Safe
3. Moderately safe
4. Unsafe
5. No idea

Tap water

1. Extremely safe
2. Safe
3. Moderately safe

4. Unsafe
5. No idea

Red meat

1. Extremely safe
2. Safe
3. Moderately safe
4. Unsafe
5. No idea

Poultry meat

1. Extremely safe
2. Safe
3. Moderately safe
4. Unsafe
5. No idea

Fish and fishery products

1. Extremely safe
2. Safe
3. Moderately safe
4. Unsafe
5. No idea

Appetizers and snacks sold under market conditions

1. Extremely safe
2. Safe
3. Moderately safe
4. Unsafe
5. No idea

Bread

1. Extremely safe
2. Safe
3. Moderately safe
4. Unsafe
5. No idea

Bakery products

1. Extremely safe
2. Safe
3. Moderately safe
4. Unsafe
5. No idea

3. Consumer's general food safety concerns:-

Microorganisms

1. Extremely dangerous
2. Dangerous
3. Not dangerous
4. I am not sure
5. I have never heard about

Pesticides and residues

1. Extremely dangerous
2. Dangerous
3. Not dangerous
4. I am not sure
5. I have never heard about

Toxic chemicals and heavy metals like mercury and lead

1. Extremely dangerous
2. Dangerous
3. Not dangerous
4. I am not sure
5. I have never heard about

Contaminations originated from laborers and personnel

1. Extremely dangerous
2. Dangerous
3. Not dangerous
4. I am not sure
5. I have never heard about

4. For a healthier life:-**“I try to consume low fat foods”**

1. Sure
2. Have a low opinion
3. No idea

“I try to purchase safe foods free of pesticides, hormones and chemical residues”

1. Sure
2. Have a low opinion
3. No idea

“I try to purchase packaged foods which are not contaminated with microorganisms”

1. Sure
2. Have a low opinion

3. No idea

“I try to consume foods free of toxic chemicals and heavy metals like mercury and lead”

1. Sure

2. Have a low opinion

3. No idea

5. Changes in food consumption habits of the consumers:-

Recent years, I try to limit my red meat consumption.

Because;

1. Fat amount of red meat is extremely high

2. Hygienic condition is poor

3. Expensive

4. Hormone residues

5. Farmers use antibiotics for healing the animals

6. I do not limit my red meat consumption

I prefer purchasing bottled water. Because;

1. Quality of tap water is poor (bad odor and taste)

2. Poor microbiologic quality

3. We have “undrinkable report” for the tap water

4. Origin of our tap water is “artesian well”

5. I do not buy bottled water. I drink tap water

Recent years, I try to limit my egg consumption.

Because;

a. High cholesterol content of egg

b. High fat amount of egg

c. Expensive

d. Microbiologically unsafe and has a poor hygienic quality

e. I do not limit my egg consumption

Recent years, I try to limit my fish and fishery products consumption. Because;

- a. They are microbiologically unsafe
- b. Storage and shipping conditions are unsafe and unhygienic
- c. Expensive
- d. Fat amount of them is high
- e. I do not limit my fish and fishery products consumption

Recent years, I try to limit my poultry meat consumption. Because;

- a. They have poor hygienic quality
- b. Expensive
- c. I know that they have hormone residues
- d. Fat amount is high
- e. Antibiotics are used for the healing of poultry
- f. I do not limit my poultry meat consumption

Recent years, I try to limit my fresh vegetable and fruit consumption. Because;

- a. Their low quality
- b. Pesticides and hormone residues
- c. Expensive
- d. They are microbiologically unsafe
- e. I do not limit my fresh vegetable and fruit consumption

6. Knowledge of the consumers on food safety and general health:-

My knowledge about food safety is,

- 4. Excellent
- 3. Good
- 2. Moderate
- 1. Inadequate

My general health condition is,

- 1. Excellent
- 2. Very good
- 3. Good
- 4. Not too bad
- 5. Bad

General health condition of my family is,

- 1. Excellent
- 2. Very good
- 3. Good
- 4. Not too bad
- 5. Bad

7. Consumer's concerns on food-borne diseases:-

Have you ever suffered from a food-borne disease

- 1.Yes
2. No, never

Have you ever suffered from a food-borne disease originated

Diarrhea

- 1.yes
- 2.no

stomach ache

- 1.yes
- 2.no

Nausea

- 1.yes
- 2.no

Vomiting

- 1.yes
- 2.no

Fever

- 1.yes
- 2.no

8. General behaviors and thoughts of consumers against food safety issues:-

I carefully check the package whether it is damaged or not

- 1.Always
2. Sometimes
- 3.Rarely
4. Never

While purchasing frozen foods, I check whether the product is really frozen or not I check the temperature of the freezer

1. Always
- 2.Sometimes
- 3.Rarely
4. Never

Are you careful about keeping raw meat or fish away from ingredients that are eaten raw like salad?

1. Always
2. Sometimes
- 3.Rarely
4. Never

Do you wash your hands before you handle food?

1. Always

2. Sometimes
3. Rarely
4. Never

I wash the utensils and clean the counter just after the preparation of the meal

1. Always
2. Sometimes
3. Rarely
4. Never

In my opinion, keeping cooked meat at room temperature for 4-5 h, do not cause food safety risks for the consumers

1. Yes, sure
2. No, I do not think so

In my opinion, using same equipment for both raw and cooked foods do not cause food safety risks to consumers

1. Yes, sure
2. No, I do not think so

To check the spoilage of the foods in refrigerator from 2-3 days ago I taste them

1. Generally
2. Sometimes
3. Never

Leftovers

1. I divide them into small portions and put into refrigerator
2. I put them into refrigerator
3. I put them into larger
4. We cook in small amounts. We have no leftover problem.

Thawing of frozen foods

1. In refrigerator conditions
2. In microwave oven
3. I put the frozen foods in a nylon bag and immerse in hot water
4. I do not purchase frozen foods

Expiration date

1. I never consume foods after expiration date
2. I check it in the market, if so, I do not purchase
3. I smell or taste, if it looks fresh I consume
4. I consume foods after 4-7 days of the expiration date
5. I consume foods after 2-3 days of the expiration date

Raw meat "marara" is a great risk for the consumer

1. I absolutely agree
2. I agree
3. I do not agree
4. I absolutely disagree
5. I have no idea

Rarely cooked meat is not a great risk for the consumer

1. I absolutely agree
2. I agree
3. I do not agree
4. I absolutely disagree
5. I have no idea

Freezing the foods kills the microorganisms in them

1. I absolutely agree
2. I agree
3. I do not agree
4. I absolutely disagree
5. I have no idea

Before replacing the hot foods into freezer, we should wait until their temperature decrease down to ambient temperature

1. I absolutely agree
2. I agree
3. I do not agree
4. I absolutely disagree
5. I have no idea

Awaiting leftovers at room temperature before replacing into refrigerator (until cooling down) do not cause food safety risks for the consumer

1. I absolutely agree
2. I agree
3. I do not agree
4. I absolutely disagree
5. I have no idea

9. Consumer's thoughts on media and food safety:-

Scientists and professors from universities

1. Extremely reliable
2. Reliable
3. Unreliable
4. Extremely unreliable

Nutritionists

1. Extremely reliable
2. Reliable
3. Unreliable
4. Extremely unreliable

Publications of consumer protection associations

1. Extremely reliable
2. Reliable
3. Unreliable
4. Extremely unreliable

Scientific journals

1. Extremely reliable
2. Reliable
3. Unreliable
4. Extremely unreliable

Magazines related to food industry

1. Extremely reliable
2. Reliable
3. Unreliable
4. Extremely unreliable

News magazine

1. Extremely reliable
2. Reliable
3. Unreliable
4. Extremely unreliable

Newspapers

1. Extremely reliable
2. Reliable
3. Unreliable
4. Extremely unreliable

Television news programmers

1. Extremely reliable
2. Reliable
3. Unreliable
4. Extremely unreliable

Radio programmers'

1. Extremely reliable
2. Reliable
3. Unreliable
4. Extremely unreliable

Daily news on TV

1. Extremely reliable
2. Reliable

- 3.Unreliable
4. Extremely unreliable

Talk shows and magazine

1. Extremely reliable
2. Reliable
- 3.Unreliable
4. Extremely unreliable

Websites and publications of government

1. Extremely reliable
2. Reliable
- 3.Unreliable
4. Extremely unreliable

Brochures of food retailers and manufacturers

1. Extremely reliable
2. Reliable
- 3.Unreliable
4. Extremely unreliable

Publications of non-governmental food-related organizations and chamber of food technologists and engineers

1. Extremely reliable
2. Reliable
- 3.Unreliable
4. Extremely unreliable

Source of consumer information on safety food

Television

- 1.yes
- 2.no

Radio

- 1.yes
- 2.no

news paper

- 1.yes
- 2.no

printed educational materials

- 1.yes
- 2.no

Internet

- 1.yes
- 2.no

Lectures

- 1.yes
- 2.no

Friends and family

- 1.yes
- 2.no

10. Consumer's opinion on degree of responsibility of different entities regarding food safety

Myself

1.yes

2.no

Government agencies

1.yes

2.no

farm owner's

1.yes

2.no

Consumer protection association

1.yes

2.no

(1) Frequency table of the 150 consumer's information source on food safety:-

	Yes (%)	No (%)
Television	86(57.3)	64(42.7)
Radio	65(43.3)	85(56.7)
News paper	26(17.3)	124(82.7)
Printed educational materials	36(24)	114(76)
Internet	65(43.3)	85(56.7)
Lectures	29(19.3)	121(80.7)
Parents and friend	101(67.3)	49(32.7)

(2) Frequency table of consumer's opinion on degree of responsibility of different entities regarding food safety:-

	Yes (%)	No (%)
Myself	112(74.7)	38(25.3)
Government agencies	78(52)	72(48)
Farm owner's	48(32)	102(68)
Consumer protection association	56(37.3)	94(62.7)