



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



**Knowledge, Attitudes and Practice of food Safety among workers at  
the federal ministry of animal resources in Sudan**

المعرفة والإتجاهات والممارسة الخاصة لسلامة الغذاء لدى العاملين برئاسة وزارة الثروة  
الحيوانية الإتحادية

**A dissertation submitted to fulfill the partial requirements for a  
master degree in preventive veterinary medicine (mpvm)**

**By**

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## **Dedication**

To the spirit of my father and my mother who let me know the real life.

To my beloved wife, sons , daughters and brothers who always support me during critical situations.

## **Acknowledgement**

**At first I wish to acknowledge the support of my supervisor prof. Mohammed Abdelsalam for his patience, guidance and encouragement. My great thanks al so to prof. Abdelhameed Ahmed Elfadil the leader of the master program in veterinary preventive medicine for his guidance and closed follow up during the study courses of this programs.**

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## **Abstract**

**Food-borne illness remains a significant source of human disease. Recent food safety failures have attracted widespread attention resulting in public confusion and mistrust on food industry and regulators. Thus, an understanding of the overall status of food safety knowledge, attitudes and practices is needed .The aim of the present study was to assess such parameters among the workers at the federal ministry of animal resources , fifty workers were selected randomly and interviewed using face - to - face questionnaire to collect information about knowledge, attitudes and practices regarding food safety .**

**The results showed that 42% had an excellent level of knowledge about food safety, 40% of consumers categorized under the good level, 12% had a moderate knowledge and 6% of them did not have the awareness and knowledge about safety of the food they consume.**

**The most important sources of information on the opinion of consumers were lectures and printed educational materials and to some extent television, radio and internet. Also 88% of consumers have expressed their responsibility to prepare a healthy and safe food for their families , while 60% approved the responsibility of the government agencies.**

**The conclusion of this study was that there is a need for more education to the consumers about food safety and food born diseases .**

## ملخص الأطروحة

تعتبر الأمراض المنقولة بواسطة الأغذية من الأمراض الهامة والمؤثرة على صحة الإنسان وقد أدت الإخفاقات المتكررة فى مجال صحة وسلامة الغذاء الى فقدان الثقة بين المستهلكين وصناعة الأغذية مما أدى الى ضرورة الاهتمام بمعرفة الوضع العام لسلامة الغذاء من حيث المعرفة وممارسات المستهلكين . وقد استهدف هذا البحث دراسة هذه المؤشرات بين العاملين برئاسة وزارة الثروة الحيوانية الإتحادية . وقد تم جمع المعلومات اللازمة عن المعرفة والرؤية والممارسات الخاصة بسلامة الغذاء لدى العاملين بواسطة إستبيان أختير له خمسون من العاملين بطريقة عشوائية .

أظهرت الدراسة أن 42% من المستهدفين على مستوى ممتاز من المعرفة بسلامة الغذاء و 40% منهم على مستوى جيد و12% لديهم معرفة متوسطة بسلامة الغذاء بينما 6% منهم لم يكن لديهم الوعى والمعرفة بسلامة الغذاء الذى يستهلكونه .

أظهرت الدراسة أيضا أن أهم مصادر المعلومات عن سلامة الغذاء بالنسبة للمستهلكين هى المحاضرات والمواد التعليمية المطبوعة , كما يرى 88% من المستهدفين فى الدراسة أنهم مسؤولون عن صحة وسلامة الطعام الذى يعدونه بينما 60% يعتبرون أن الجهات الحكومية هى المسؤلة عن صحة وسلامة الغذاء للمستهلكين .

خلاصة هذه الدراسة أن المستهلكين فى حوجة للمزيد من التعليم والمعرفة عن سلامة الغذاء والأمراض المنقولة بواسطة الغذاء.

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## Introduction

Food safety is a scientific discipline describing handling, preparation, and storage of food in ways that prevent food borne illness. Food can transmit disease from person to person as well as serve as a growth medium for bacteria that can cause food poisoning.

Food borne diseases, intoxications and zoonoses are important public health problems that affect health and disrupt community, business and economic activities in both developed and developing countries. The foods most frequently involved in disease outbreaks are those of animal origin especially beef, poultry, pork, milk, fish and eggs. One third of the human population in developed countries is affected by food-borne diseases every year and, the problem is likely to be even more widespread in developing countries. Globally, unsafe food causes disease in at least one person in three every year. *Mead et al (1999)* reported that, in the USA, some 76 million food-borne cases occur annually. According to a report by the WHO/DFID-AHP conference, the impact of food-borne diseases, intoxications and zoonoses on health and well-being is greatest among the 800 million food-insecure livestock keepers, traders, laborers and consumers.

In developed countries there are intricate standards for food preparation, whereas in lesser developed countries the main issue is simply the availability of adequate safe water, which is usually a critical item. [*Jacob et al*]. In theory, food poisoning is 100% preventable.

The five key principles of food hygiene, according to WHO, are:

1. To prevent contaminating food with pathogens spreading from people, pets, and pests.
2. To separate raw and cooked food to prevent contaminating the cooked food.



3. To cook food for the appropriate length of time and at the appropriate temperature to kill pathogens.
4. To store food at the proper temperature.
5. To use safe water and raw materials.

Food may be exposed to contamination with the major sources from water, air, dust, equipments, sewage, insects, rodents and employees. Due to the changes in food production, handling and preparation techniques as well as eating habits, the fact remains that food is the source of microorganisms that can cause illness. Risk communication and consumer education to promote safer handling of food can be the best way of managing the risk of food borne illness as the consumer is the end of the food chain. Thus, an understanding of the overall status of food handling knowledge and practices is needed.

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) and 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 misshandling associated with specific pathogens (Bruhan ,1997).

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).

**Problem Statement :**

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

**Objectives of the study**

1. To assess the knowledge, attitude and practices related to food safety among the workers at the federal ministry of animal resources.
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.

## Chapter one

### Literature Review

#### 1.1. Knowledge, Attitudes and Practices (KAP) :

Knowledge accumulates through learning processes which may be formal or informal instruction, personal experience and experiential sharing (Tracy 2011).

Attitudes involves evaluated concepts associated with the people think , feel and behave , it comprises a cognitive , emotional and behavioral component implying what you know , how you feel and what you do ( Keller 2007 ).

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

Previous study by Somiya (2006) from Ahfad university , school of health sciences evaluate the food safety knowledge , attitudes and practices among women in Khartoum city , the study reveals that age was significantly correlated with the confidence in safety of poultry , milk and dairy products while educational level with that of meat , milk and dairy products. It also significantly influenced the purchasing behavior of meat and poultry . Age also correlated with the knowledge of some common food born diseases , food thawing and labeling while educational level with that of food labeling and food born illness .

Across sectional study by Maryam *et al* from school of veterinary medicine , Shiraz university , Iran .The study evaluate the knowledge , attitudes and practices of workers in meat processing plants. The results indicate that there is an acceptable level of knowledge , excellent attitudes and poor practices towards food hygiene measures . The study also shows lack of knowledge about microbial food hazards and

negative correlation between knowledge and practices , attitudes and practices .

Study done by Siow Oi Nee and Norrakiah Abdullah Sani from Malaysia to evaluate the level knowledge , attitudes and practices among food handlers . The study reveals that the respondents share a good knowledge on personal hygiene and definition of food born diseases (93.85%) and poor knowledge on food storage and preparation temperature ( 28%) and they showed a good attitudes in food handling .

Another study by Sufen Liu et al from china evaluate the knowledge , attitudes and practices of food safety among food handlers in a coastal resort area in order to identify the risk factors contributing to food born disease out breaks . The majority of respondents did not know the maximum stored time at room temperature , they have positive attitudes about food safety and training , there was significant variance among different food establishments ,different ages and different times of training .

Studies have found that food safety training is positively associated with self-reported changes in food safety practice (Clayton et al 2002) and improved attitudes (Wie and Strohbehn 1997 ).

Other studies found that training helps to improve the overall employee knowledge about food safety(Castello et al1997,Finch and Daniel 2005,Howes et al1996), although others found that training is not consistently associated with improved knowledge (Luby ,Jones and Horan 1993 and Pilling et al 2008 ).

A recent study by Ola (2014) in Khartoum state shows that television and radio are the most important sources of information for the consumers and there is a direct relationship between the internet and the level of consumers

knowledge , al so the degree of knowledge of each individual has strong link with his life style .

## **1.2.Food safety**

Food safety is the assurance that food will not cause any harm to the consumers when taken in its current state and as it is (FAO/WHO, 2001). Food-borne diseases and zoonoses exerts a major toll on health as thousands of millions of people fall ill and many die as a result of unsafe food. Serious outbreaks of food- borne diseases and zoonoses have been documented on every continent illustrating both their public health and social significance. Due to this, WHO (2000) recognized food safety as an essential public health priority and later on adopted the WHO global food safety strategy (WHO, 2002). According to the WHO (2000) global food safety strategy, traditional food safety management systems have not been effective in preventing food-borne diseases and zoonoses over the last decades. The strategy therefore, advocates food safety programmes based on a broader science based concept of risk assessment, risk management through process controls along the entire production chain and risk communication. This is a farm to table approach and involves considerations of every step in the chain, the community and all actors from raw material to consumption. The strategy also advocates sustainable agriculture production systems and redirection of some of the existing approaches to ensure they meet the challenges of global food safety (WHO, 2002).

### **• 1.3.Food-borne diseases :**

Food borne diseases are still among the most widespread health problems in the contemporary world. In rich and poor countries are like each other, they pose substantial health burdens, ranging in severity from mild indisposition to fatal illnesses (Tracy, 2011)

Due to the fast pace of living, most people take advantage of eating in restaurants and buying readymade food (Haryani et al.,

2007). However, food contamination by food handlers could occur and leading to food borne diseases if they neglect proper food handling practices in their premises. Every year, food borne diseases outbreaks associated with consumption of contaminated foods cause millions of cases and thousands of deaths worldwide, making food borne 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 Arie et al (2010) 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 food borne 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 and 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).

About 75% of the new communicable diseases that have affected humans over the last 10 years were caused by pathogens originating from animals or animal products (WHO, 2007). Zoonotic pathogens are a major contributor to human food-borne diseases in both developed and developing countries (Schlundt, 2002). They are transmitted during handling of infected livestock at the farm, markets, slaughterhouse, processing and transportation, at the butchery or during preparation of food (Hubbert, 1996). In many countries and especially in developing ones, millions of people are affected by preventable zoonoses such as Rabies, Rift Valley Fever, Brucellosis, Leishmaniasis, Echinococcosis, Tularemia, amongst others (WHO, 2002). The burden of zoonoses falls disproportionately on poor rural communities which have poor sanitary living conditions and low education that are considered as potential risk factors in many developing countries (Perry et al., 2002). The close association between poor rural people and

domestic livestock in large areas of developing countries promotes an opportunity for multiple infections with zoonotic diseases through direct exposure or vector-borne transmission route (Coleman, 2002). As the level of awareness of food-borne zoonoses pathogens grow, demand for safer livestock and their products will increase from consumers locally and internationally (Correa and Gerster, 2003). Producers, processors and traders would therefore be called upon to assure the safety and quality of these products (WHO, 2002).

#### **1.4. Knowledge, Attitudes and Practices (KAP) on Food Safety and Foodborne Diseases:**

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).

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 (Eduarda et al 2007) .

### **1.5.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 (Bruhn ,1997).

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

## **Chapter two**

### **Materials and methods**

#### **2.1. Study area and target population:**

The federal ministry of animal resources is one of the ministries that make the federal government of Sudan.

The target population of this study was the workers at this ministry , the workers population consists of veterinarians, animal production and other graduates ,technicians, clerks and labors .

#### **2.2.Study design:**

Face –to-face questionnaire was used to collect information about knowledge , attitudes and practices of the target population regarding food safety. Levels of people's knowledge about food safety selected according to the five keys to safer food which are mentioned by WHO (2010). 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.

Fifty workers were selected randomly to be interviewed by filling the questionnaire which was conducted during February – march 2016.

#### **2.3.Data analysis:**

The data collected was analyzed simply to calculate the percentage for different answers in order to identify the knowledge of respondents and their concerns about food safety.

## Chapter Three

### Results

- **Demographic Characteristics of Consumers:**

The 50 consumers interviewed were:33(66%) between 20 and 40 years of age, 18(36%) were males and 32(64%) were females, 29(58%) of them were married while 21(42%) were single, 3(6%) of were have elementary school education, 4(8%) were have a high school education and 43(86%) of them were university graduates.

**Table (1): Demographical characteristics of consumers at the federal ministry of animal resources - Sudan**

Variables	Frequency	Percent (%)
Age(year)		
20	1	2
20-40	33	66
40<	16	32
Sex		
Male	18	36
Female	32	64
Marital status		
Married	29	58
Single	21	42
Education		
Elementary	3	6
High school	4	8
University	43	86

- **2. Knowledge of the consumers on food safety**

The results showed that 42% of the respondents had an excellent level of knowledge about food safety, 40% of them were categorized under a good level, 12% had a moderate knowledge,

and 6% of them did not have the awareness and knowledge about safety of the food they consumed (Table 2 ).

**Table (2): The level of Knowledge on food safety among the respondents:-**

	Frequency	Percent
Excellent	21	42
Good	20	40
Moderate	6	12
Inadequate	3	6
Total	50	100

- **Consumer's food safety concerns related to several foods**

Table (3) below showed that the respondents had a moderate confidence on several foods such as raw vegetables and fruits , eggs, red meat, poultry meat, fish, bread ,bakery products, bottled and tap water while the result reveals that dairy products, appetizers and snacks were unsafe .

**Table (3): Consumer's food safety concerns related to several foods among respondents:-**

	Extremely safe	Safe	Moderate safe	Unsafe	No idea
Bottled water	3(6%)	9(18%)	25(50%)	7(14%)	6(12%)
Raw vegetables and fruits	6(12%)	8(16%)	20(40%)	14(28%)	2(4%)
Dairy products	2(4%)	4(8%)	13(26%)	29(58%)	2(4%)

Egg	5(10%)	13(26%)	21(42%)	9(18%)	2(4%)
Tap water	3(6%)	4(8%)	21(42%)	20(40%)	2(4%)
Red meat	4(8%)	6(12%)	22(44%)	16(32%)	2(4%)
Poultry meat	4(8%)	10(20%)	22(44%)	13(26%)	1(2%)
Fish	13(26%)	16(32%)	18(36%)	2(4%)	1(2%)
Appetizers and snacks	1(2%)	6(12%)	29(58%)	11(22%)	1(2%)
Bread	3(6%)	6(12%)	29(58%)	11(22%)	1(2%)
Bakery products	5(10%)	4(8%)	21(42%)	16(32%)	4(8%)

- **Consumer's general food safety concerns:**

Most respondents express their high concern about pesticides and their residues(84%) and toxic chemicals and heavy metals (92%), also they show moderate concern about microorganisms and some farness from contamination originated from laborers .

**Table (4): Consumer's general food safety concerns:-**

	Extremely dangerous (%)	Dangerous (%)	Not dangerous (%)	I am not sure (%)	I have never heard about (%)	Total (%)
Microorganisms	31(62%)	15(30%)	2(4%)	2(4%)	0(0%)	50(100)
Pesticides and residues	42(84%)	8(16%)	0(0%)	0(0%)	0(0%)	50(100%)
Toxic chemicals and heavy metals	47(94%)	3(6%)	0(0%)	0(0%)	0(0%)	50(100%)
Contaminations originated from laborers	24(48%)	24(48%)	0(0%)	0(0%)	2(4%)	50(100%)

- **Consumers' habits changes in food consumption**

In table (5): most of respondents did not limit their consumption due to any critical reasons that mentioned in the questionnaire ( fresh vegetables and fruits, poultry meat, fish and eggs) while 30%, 46% were limit their consumption of red meat and fish respectively due to expensiveness.

**Table (5) Changes in food consumption habits of the consumers at the federal ministry of animal resources:**

1:limit my fresh vegetable and fruits consumption		
	Frequency	Percent
low quality	3	6
Pesticides	10	20
Expensive	7	14
Unsafe	5	10
I don't limit	25	50
Total	50	100

2:limit my poultry meat consumption		
	Frequency	Percent
poor hygienic quality	3	6
Expensive	10	20
hormone residues	6	12
high fat	1	2
antibiotic for healing	8	16
I don't limit	22	44
Total	50	100

3:limit my fish and fishery products		
	Frequency	Percent
Unsafe	4	8
unhygienic storage	3	6
Expensive	23	46
high fat	0	0
I don't limit	20	40
Total	50	100

4:limit my egg consumption		
	Frequency	Percent
high cholesterol	15	30
high fat	1	2
Expensive	8	16
poor hygiene	9	18
I don't limit	17	34
Total	50	100

5:purchasing bottled water		
	Frequency	Percent
tap water is poor	6	12
poor microbiologic quality	10	20
undrinkable report	3	6
I don't buy bottled water	31	62
Total	50	100

6:limit my red meat consumption		
	Frequency	Percent
Fat	13	26
poor hygiene	6	12
Expensive	15	30
antibiotics for healing	2	4
I don't limit	14	28
Total	50	100



- **General behavior and thoughts of consumers at the federal ministry of animal resources:**

Tables (6.) below revealed that 94% of the respondents always wash their hands before handling food and 78% wash the utensils and clean the counter just after the preparation of the meal .

Also to treat leftover food, 46% put it in the refrigerator,32% divided it in to small portions then put in the refrigerator ,33% thaw the frozen food in the refrigerator condition, while 44% do not purchase frozen food .

- **Table (6) General behavior of consumers at the federal ministry of animal resources:**

	Always	Sometimes	Rarely	Never
I carefully check the package whether it is damaged or not	30(60%)	14(28%)	6(12%)	0(0%)
Are you careful about keeping raw meat or fish away from ingredients that are eaten raw like salad?	29(58%)	11(22%)	3(6%)	7(14%)
Do you wash your hands before you handle food?	47(94%)	3(6%)	0(0%)	0(0%)
I wash the utensils and clean the counter just after the preparation of the meal	39(78%)	9(18%)	1(2%)	1(2%)
<b>Leftover</b>				
			Frequency	Percent
1. I divide them into small portions and put into refrigerator			16	32
2. I put them into refrigerator			23	46
3. I put them into larger ....			4	8
4. We cook in small amounts. We have no leftover problem.			7	14
Total			50	100

Thawing of frozen food		
	Frequency	Percent
1.In refrigerator conditions	15	30
2. In microwave oven	10	20
3.I put the frozen foods in a nylon bag and immerse in hot water	3	6
4. I do not purchase frozen foods	22	44
Total	50	100

- **General thoughts of consumers at the federal ministry of animal resources:**

The consumers opinion about hazards originated from keeping cooked meat at room temperature for 4 – 5 hours was, 56% were sure about that, while 44% do not think so . Also about using the same equipments for both raw and cooked food, 52%were sure about the risk while 48%were do not think so.

76% of the respondents considered that raw meat was a great risk for them and 80% agree that rarely cooked meat is risky for the consumer, for placing hot food in to freezer, 60% said that they should wait until the food temperature decrease to ambient temperature(table 7).

- **Table (7) General thoughts of consumers at the federal ministry of animal resources:**

keeping cooked meat at room temperature for 4–5 h, do not cause food safety risks for the consumers		
	Frequency	Percent
1. Yes, sure	28	56
2. No, I do not think so	22	44
Total	50	100

using same equipment for both raw and cooked foods do not cause food safety risks to consumers		
	Frequency	Percent
1. Yes, sure	26	52
2. No, I do not think so	24	48
Total	50	100

	absolutely agree	Agree	do not agree	absolutely disagree	have no idea	Total
Raw meat is a great risk for the consumer	23(46%)	15(30%)	3(6%)	1(2%)	8(16%)	50(100%)
Rarely cooked meat is a great risk for the consumer	17(34%)	23(46%)	5(10%)	3(6%)	2(4%)	50(100%)
Freezing the foods kills the microorganisms in them	9(18%)	15(30%)	13(26%)	4(8%)	9(18%)	50(100%)
Before replacing the hot foods into freezer, we should wait until their temperature decrease down to ambient temperature	30(60%)	18(36%)	2(4%)	0(0%)	0(0%)	50(100%)

- **Source of information:**

Table (8) showed that: lectures and printed educational materials were the most important sources of information to the respondents.

**Table 8: Source of information**

	YES (%)	NO (%)
Television	39(78)	11(22)
Radio	36(72)	14(28)
News paper	29(58)	21(42)
Printed educational materials	41(82)	9(18)
Internet	38(76)	12(24)
Lectures	43(86)	7(14)
Parents and friend	38(76)	12(24)

- **Responsibility for food safety**

About 88% of the respondents have expressed responsibility to prepare a healthy and safe food (Table 9), also 60% of them approved the responsibility of the government agencies. On the other hand, 50% of them consider that there is also the responsibility of farm owner's for the production of component of a healthy food and free from contaminants and 74% put the responsibility to the consumer protection association.

Table (9): Consumer's opinion on degree of responsibility of different entities regarding food safety at the federal ministry of animal resources:

	YES ( % )	NO ( % )
Myself	44(88)	6(12)
Government agencies	30(60)	22(44)
Farm owner's	25(50)	25(50)
Consumer protection association	37(74)	13(26)

## Chapter Four

### Discussion

This study provides information and reveals many features about knowledge, attitudes and practices of food safety among workers at the federal ministry of animal resources.

The study shows that ( 82%) of the respondents have between good to excellent level of knowledge about food safety, they have a moderate confidence on some foods and drinks such as red meat ,poultry meat, fish ,eggs, raw vegetables and fruits ,bread, bakery products, bottled and tap water, while dairy products, appetizers and snacks reveals unsafe .Study done by Somiya in Khartoum state (2006) shows that age was significantly related to confidence in the safety of poultry , milk and their products ,some consumers have a high confidence on egg , fish and bread ( Ola 2014) , Confidence in food safety increased with age ( Miles 2004).

In the general food safety concerns ; respondents express high concern about pesticides, their residues, chemicals and heavy metals. Moderate concern about microorganisms, while other study shows high concern about microorganisms and some farness about chemicals and heavy metals.

About 35% of respondents limit their consumption of red meat and fish due to expensiveness . Most of respondents have a good food hygiene practice by washing their hands before handling food , washing utensils and clean the counter just after preparing food , this result was in the same line with national Australian food safety telephone survey which reveals that most of consumers wash their hands with soap or detergent ,felt that it was very important to wash hands before and after preparing meals (Jay *et al* 1999).

Reports indicated that simple act of washing hands with soap and water reduces the incidence of diarrhea caused by shigella and other causes by up to 35% (WHO 1999).

Montville *et al* (2001) believe that the proper use of gloves decrease transfer of pathogens from hands to food, but Guzewich and Ross (1999) reported that gloves use may promote poor hand washing practice .

About half of the respondents sure that there is no hazard originated from keeping cooked meat for 4- 5 hours at room temperature and al so from using the same equipments for both raw and cooked food , this was in the same line with the results of the study by Ola (2014) that showed that half of consumers were sure that leaving cooked food for 4-5 hours at room temperature was not caused a food safety risk ,and most of them sure that using the same equipments for raw and cooked food is risky for food safety and al so raw meat is a great risk for consumers food safety .

In this study 76% of the respondents agreed that raw meat is a great risk for the consumers , this result was nearly similar to that in the study conducted by Ola (2014) .

Most of consumers take their information about food safety from ; television ,radio, news papers , printed educational materials and parents and friends but the higher score was from lectures (86%), this result was proportionally higher than that recorded by Jevsink (2008) (53%) and Ola (2014) (67.3%).

Different components of mass media provide information that increase top-of-mind awareness of the hazards concerning food safety(Tetlock 2007).

USDA – FSIS(2002) reported that consumers were more knowledgeable about food safety , but their knowledge was not always reflected in their food handling behavior.

The present study also reveals that the consumers were responsible for safety of food that they consumed (88%) which is higher than any of the entities that mentioned in the study , however Jevsink et al (2008) stated that ;consumers believe that they were not responsible for the food safety to the same degree as food handlers .

## **Conclusion**

In spite of consumer's good knowledge and practices about food safety, there is a need for more education to the consumers about food safety and food borne diseases.

## **Recommendations**

1. Refining and updating of legislations concerning food safety.
2. Community food safety training using acceptable tools for the consumers .
3. More researches and studies about food safety should be conducted.
4. Food safety information should be age – specific, school – based , and reinforced through classes.

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# Appendix

**CODED QUESTIONNAIRE**  
**Sudan University of Science & Technology**  
**College of Postgraduate Studies**  
**Master of Preventive Veterinary Medicine**  
**Consumer awareness and knowledge to food safety**  
**Federal Ministry of animal resources**

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.

## 1. Demographical characteristics of consumers:-

Age	
1.<20:	
2.20–40:	
3.>40:	
<b>Gender</b>	
1.Female:	
2.Male:	
<b>Marital status</b>	
1.Married:	
2.Single:	
<b>Education</b>	
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	
<b>Raw vegetables and fruits</b>	
1. Extremely safe	
2. Safe	
3. Moderately safe	
4. Unsafe	
5. No idea	
<b>Dairy products sold under market conditions</b>	
1. Extremely safe	
2. Safe	
3. Moderately safe	
4. Unsafe	
5. No idea	
<b>Egg</b>	
1. Extremely safe	
2. Safe	
3. Moderately safe	
4. Unsafe	
5. No idea	
<b>Tap water</b>	
1. Extremely safe	
2. Safe	
3. Moderately safe	
4. Unsafe	
5. No idea	
<b>Red meat</b>	
1. Extremely safe	
2. Safe	
3. Moderately safe	
4. Unsafe	
5. No idea	
<b>Poultry meat</b>	
1. Extremely safe	
2. Safe	
3. Moderately safe	
4. Unsafe	
5. No idea	
<b>Fish and fishery products</b>	
1. Extremely safe	
2. Safe	
3. Moderately safe	
4. Unsafe	
5. No idea	
<b>Appetizers and snacks sold under market conditions</b>	
1. Extremely safe	
2. Safe	
3. Moderately safe	

4. Unsafe	
5. No idea	
<b>Bread</b>	
1. Extremely safe	
2. Safe	
3. Moderately safe	
4. Unsafe	
5. No idea	
<b>Bakery products</b>	
1. Extremely safe	
2. Safe	
3. Moderately safe	
4. Unsafe	
5. No idea	

**3. Consumer's general food safety concerns:-**

<b>Microorganisms</b>	
1. Extremely dangerous	
2. Dangerous	
3. Not dangerous	
4. I am not sure	
5. I have never heard about	
<b>Pesticides and residues</b>	
1. Extremely dangerous	
2. Dangerous	
3. Not dangerous	
4. I am not sure	
5. I have never heard about	
<b>Toxic chemicals and heavy metals like mercury and lead</b>	
1. Extremely dangerous	
2. Dangerous	
3. Not dangerous	
4. I am not sure	
5. I have never heard about	
<b>Contaminations originated from laborers and personnel</b>	
1. Extremely dangerous	
2. Dangerous	
3. Not dangerous	
4. I am not sure	
5. I have never heard about	

**4. 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	
<b>I prefer purchasing bottled water. Because;</b>	
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	
<b>Recent years, I try to limit my egg consumption. Because;</b>	
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	
<b>Recent years, I try to limit my fish and fishery products consumption. Because;</b>	
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	
<b>Recent years, I try to limit my poultry meat consumption. Because;</b>	
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 no limit my poultry meat consumption	
<b>Recent years, I try to limit my fresh vegetable and fruit consumption. Because;</b>	
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	

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

My knowledge about food safety is,	
4. Excellent	
3. Good	
2.Moderate	
1. Inadequate	
<b>My general health condition is,</b>	
1. Excellent	
2. Very good	
3.Good	
4. Not too bad	
5.Bad	
<b>General health condition of my family is,</b>	



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

**6. Consumer's concerns on food-borne diseases:-**

Have you ever suffered from a food-borne disease	
1. Yes	
2. No, never	
<b>Have you ever suffered from a food-borne disease originated</b>	
<b>Diarrhea</b>	
1. yes	
2. no	
<b>stomach ache</b>	
1. yes	
2. no	
<b>Nausea</b>	
1. yes	
2. no	
<b>Vomiting</b>	
1. yes	
2. no	
<b>Fever</b>	
1. yes	
2. no	

**7. 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	
<b>While purchasing frozen foods, I check whether the product is really frozen or not I check the temperature of the freezer</b>	
1. Always	
2. Sometimes	
3. Rarely	
4. Never	
<b>Are you careful about keeping raw meat or fish away from ingredients that are eaten raw like salad?</b>	
1. Always	
2. Sometimes	
3. Rarely	
4. Never	

<b>Do you wash your hands before you handle food?</b>	
1. Always	
2. Sometimes	
3. Rarely	
4. Never	
<b>I wash the utensils and clean the counter just after the preparation of the meal</b>	
1. Always	
2. Sometimes	
3. Rarely	
4. Never	
<b>In my opinion, keeping cooked meat at room temperature for 4–5 h, do not cause food safety risks for the consumers</b>	
1. Yes, sure	
2. No, I do not think so	
<b>In my opinion, using same equipment for both raw and cooked foods do not cause food safety risks to consumers</b>	
1. Yes, sure	
2. No, I do not think so	
<b>To check the spoilage of the foods in refrigerator from 2–3 days ago I taste them</b>	
1. Generally	
2. Sometimes	
3. Never	
<b>Leftovers</b>	
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.	
<b>Thawing of frozen foods</b>	
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	
<b>Expiration date</b>	
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	

<b>Raw meat “marara”is a great risk for the consumer</b>	
1. I absolutely agree	
2. I agree	
3.I do not agree	
4. I absolutely disagree	
5.I have no idea	
<b>Rarely cooked meat is not a great risk for the consumer</b>	
1. I absolutely agree	
2. I agree	
3.I do not agree	
4. I absolutely disagree	
5.I have no idea	
<b>Freezing the foods kills the microorganisms in them</b>	
1. I absolutely agree	
2. I agree	
3.I do not agree	
4. I absolutely disagree	
5.I have no idea	
<b>Before replacing the hot foods into freezer, we should wait until their temperature decrease down to ambient temperature</b>	
1. I absolutely agree	
2. I agree	
3.I do not agree	
4. I absolutely disagree	
5.I have no idea	
<b>Awaiting leftovers at room temperature before replacing into refrigerator (until cooling down) do not cause food safety risks for the consumer</b>	
1. I absolutely agree	
2. I agree	
3.I do not agree	
4. I absolutely disagree	
5.I have no idea	

**8. consumer's information source on food safety:-**

<b>Myself</b>	
1.yes	
2.no	
<b>Government agencies</b>	
1.yes	
2.no	
<b>farm owner's</b>	
1.yes	
2.no	
<b>Consumer protection association</b>	
1.yes	
2.no	

**9. Consumer's opinion on degree of responsibility of different entities regarding food safety :**

<b>Television</b>	
1.yes	
2.no	
<b>Radio</b>	
1.yes	
2.no	
<b>news paper</b>	
1.yes	
2.no	
<b>printed educational materials</b>	
1.yes	
2.no	
<b>Internet</b>	
1.yes	
2.no	
<b>Lectures</b>	
1.yes	
2.no	
<b>Friends and family</b>	
1.yes	
2.no	