بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Postgraduate Studies

Assessment of Knowledge, Attitude and Practices of Customers Regarding Personal hygiene and Safety Standards of Handlers in Food Facilities in Al Dilling City –South Kordufan State

تقييم المعرفة وموقف وممارسات العملاء نحو النظافة ومعايير السلامة للعاملين فى مرافق الأغذية فى مدينة الدلنج- ولاية جنوب كردفان

A thesis Submitted for Fulfillment of Award of Master Degree in Preventive Veterinary Medicine (MVPM)

By:

Alia Ahmed Gango Omer

B.V.M, (2013) Faculty of Veterinary Medicine

University of West Kordufan

Supervisor:

Professor: Mohammed Abdelsalam Abdalla

Department of Preventive Veterinary Medicine and Public Health, College of Veterinary Medicine, Sudan University of Science and Technology

(December 2020)

إستهـــلال

بِسْـمِ اللّهِ الرَّحْمَنِ الرَّحِيـمِ

قَالَ تَعَـالَىٰ:

﴿ وَٱلۡأَنۡعَٰمَ خَلَقَهَاۖ لَكُمۡ فِيهَا دِفۡءٞ وَمَنَٰفِعُ وَمِنۡهَا تَأۡكُلُونَ ٥ وَلَكُمۡ فِيهَا جَمَالٌ حِينَ تُرِيحُونَ وَحِينَ تَسۡرَحُونَ ٦ وَتَحۡمِلُ أَثۡقَالَكُمۡ إِلَىٰ بَلَدٖ لَّمۡ تَكُونُواْ بَٰلِغِيهِ إِلَّا بِشِقِّ ٱلۡأَنفُسِۚ إِنَّ رَبَّكُمۡ لَرَءُوفٞ رَّحِيمٞ ٧ ﴾

صدق الله العظيـم

سورة النحل الآية (5,6,7)

Dedication

This work is dedicated to:

The dearest of my mother,

My father,

Brothers and sisters

Who support and

Encouragement

To continue my studies

Acknowledgment

Firstly, Praise to Allah, who honored me and blessed me, that help me to accomplishment this research, thanks god first and foremost.

Thanks to giant academic welfare Sudan University of science and technology. Thanks to deanship graduate studies, thanks to the faculty of the veterinary Medicine. Thanks and appreciation to my brother Dr. Ashraf Ahmed Gango who supports me and stood beside me to finish the research. Thanks and appreciation to all my family who supports me and stood beside me. After that l extend my thanks and appreciation to Professor Mohammed Abdelsalam abdallah and Professor Siham Elias Suliman Mohammed who supervised this research and surrounded me to know and made effort in the follow up and guidance. I ask Allah to bless in his knowledge and his age and keep him to generations as teacher and guide.

Thanks to Dr. Gango Ali Hamed who stood beside me and help me, Thanks to teacher Hassaballa Mohammed Noga who stood beside me in the analysis phase of the questionnaire, Thanks to all libraries that l have benefited from them and websites. Thanks to the management livestock in Al Dilling locality, and thanks to my friend's in the veterinary of Dilling, who help me to fill the questionnaire, and stood beside me.

Finally l would like to thank all those who contributed and supported encourage and supported the completion of this research.

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Abstract

A cross sectional study was carried out in December 2018 In Al Dilling city – south Kordufan state – Sudan. The objective of this study was to assess of the Knowledge, Attitude and Practices of customers regarding food facilities as well as potential associated factors, and awareness of handlers in food facilities by assessing of their educational levels and professional training, experiences and personal hygiene on food facilities. A questionnaire was designed random selection. In result the simple correlation was used to identify the associated factors with the KAPs. Among 200 customers, (R=0.630) there were positive correlation between knowledge about food hygiene and safety among customers in food facilities and avoided foodborne illness, (R square =0.521). There were significant difference between criteria when choosing food facilities and monthly income (P-value=0.025). Most of customers considered the processing and selling of hygienic meals without leaving any food overnight as the most important feature in food facilities 42%. About 56.5% of participants chose report food safety violation by facilities to authorities. The most handlers 35% work in the food facilities in stage of secondary education. The higher score of knowledge were found in group of people who were single, had college /University or higher education and had specific criteria when choosing their place to eat. The management and awareness of customers in food facilities because they are responsible for maintenance of hygienic standards. Food will be safe and a number of foodborne diseases will be eradicated.

ملخص البحث

هذه دراسة مقطعية (مقطع زمانى و مكانى محدد) اجريت فى ديسمبر 2018 فى مدينة الدلنج - ولاية جنوب كردفان – السودان. الهدف من هذة الدراسة هو تقييم مدى معرفة و سلوك و ممارسات العملاء فى مرافق الاغذية و كذلك العوامل المرتبطة المحتملة و معرفة المستوى التعليمى لهم وخبرتهم العملية فى مجال الاغذية والنظافة الشخصية للعمال فى مرافق الاغذية. و تم ملأ الإستبيان بالإختيار العشوائى. فى النتيجة هذة الدراسة استخدمت علاقة بسيطه فى التحليل لحديد هوية العوامل المرتبطة بالمعرفه و السلوك والممارسات حول نظافة الاغذية. بين 200 مشارك (R=0.30) هو عبارة عن إرتباط إيجابى بين المعرفه حول صحة وسلامة الاغذيه بين العملاء وتجنب الامراض المنقولة عن طريق الاغذية، (R- square=0.521) اى هنالك اختلاف كبير بين المعايير التى يجب اتباعها عند اختيار مرافق الاغذية والدخل الشهرى (P- value=0.025) فى اختبارANOVA.

يعتبر معظم المشاركين فى الدراسة بنسبة (42%) ان تجهيز وبيع الطعام بطريقه صحية دون ترك اي طعام خلال الليل كأهم ميزة فى مرافق الاغذية، بعض من المشاركين فى الدراسة انهم سوف يبلغون عن اى انتهاكات فى سلامة وصحة الاغذية للسلطات المحلية.

معظم العمال الذين يعملون فى مرافق الاغذية بالدلنج (35%)، فى مرحلة التعليم الثانوى.

توجد اعلى نسبة من المعرفة والنظافة الجيدة عند الأشخاص غير المتزوجين و الذين يدرسون فى الكليات والجامعات أو التعليم العالى، لديهم معايير معينة لاختيار مكان تناول الطعام.

الإدارة وتوعية العملاء فى مجال الأغذية لانهم الذين يقومون بالنظافة و المعايير الصحيه للاغذية. سيكون الغذاء آمناً و سيتم القضاء على عدد من الأمراض التى تنتقل عن طريق الغذاء.

Introduction

Foodborne disease, which result from consuming food having contaminants of viruses, bacteria, parasites, and allergens, have been a seemingly never ending threat to public health and significant hindrance to the development of socioeconomic worldwide. In low and middle income countries, foodborne illnesses have a tendency to increase due to surge witnessed in conception of risky foods, namely farm animals, fish products, and fresh produce (Uyttendaele *et al* 2015). The continent of Africa and Southeast Asia have been deemed to have a highest rates of incidence and mortality associated with foodborne diseases (Adane *et al* 2018). The microorganisms in different parts of food, carried out on food from original animal, and poultry products, contribute significantly to foodborne diseases in humans during processing, a high proportion of this organisms will be removed and will result in reducing the incidence of illnesses but further contaminations may occur at any stage of processing operation (Kabour, 2011). In Sudan Ministry of health, South Kordufan state, Dilling locality (2017) reported that incidents of Diarrhea Disease that affected about 6,815 people, and reported about 293 incidents of Cholera affected people and the mortality about 33 cases. This numbers might just be an underestimation, since there were potentially many cases uninvestigated in the communities.

Personal hygiene is critical in preventing contamination of food and foodborne illness, they must wash their hands properly to prevent contaminating other foods, and surfaces they touch (Medeiros *et al*., 2001). In Sudan (Siham *et al.,* 2010) recorded that all persons in contact with food and food products must know hygienic practices during their duty to prevent the food and its products from contamination. Gould (1994) reported that all handlers must have

participated in training program in personal hygiene, good manufacturing practice, cleaning and disinfection procedures before training to work in the plant. All those handlers food, farmers, food producers, individuals who work in markets and food service establishment, and other food prepares have a responsibility to keep food as safe as possible. Training helps to improve overall employee knowledge of food safety (Howes *et al***.,** 1996).

Knowledge, Attitude, Practices (KAP) assessment a representative study of a specific population to collect information on what is known, believed and acted on relation to particular topic (WHO, 2008) by using Questionnaires.

KAP study can be conducted by quantify and measure an incident through the use of questionnaires and statistical generate the level of knowledge and awareness of personal workers in food production. Thus, the KAP information should be transferred to educational training programs in order to address the lake of knowledge and increase the awareness of personal hygiene in food facilities.

Objective of the study

1. To explore the Knowledge, Attitude and Practices of customers regarding food facilities as well as potential associated factors in Al Dilling.

2. To show the effect of awareness and educational level on hygienic and health status in the food facilities.

Chapter one

Literature review

1.1 Food safety:

Food safety is the assurance that food will not cause any harm to the customers when taken in its current state and as it is (FAO/WHO, 2001).Foodborne diseases and zoonosis exerts a major toll on health as thousands of millions of people fall ill and many die as a result of un safe food. Serious outbreaks of foodborne diseases and zoonosis have been documented every continents illustrating both their public health and social significance. Due to this, WHO (2000) recognized food safety as essential public health priority and later on adopted the WFO global food safety strategy (WHO, 2002). According to (WHO, 2002) global food safety strategy, traditional food safety management systems have not been effective in preventing foodborne diseases and zoonosis over the last decades. The strategy therefor, advocates food safety programmers based on a broader science based concept of risk assessment, risk management.

Through progress control long the entire production chins and risk communication. This is farm to table approach and involves consideration of every step in the chin, 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).

1.2 Food borne diseases:

Contaminated food and water have been known to be source of illness in human. Food borne disease are still among the most widespread health problems in the contemporary world. In rich and poor countries alike, substantial health burdens, ranging in severity from mild indisposition to fatal illness (Tracy, 2011). Every year food borne outbreaks associated with conception of contaminated foods cause millions of cases and thousands of death 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 zoonosis, are transmitted through food, and many other diseases, including cancers are associated with chemicals and toxins in the food supply. This existing burdens will be compounded by the effects of climate change which is likely to increase the incidence of food borne diseases because of the faster growth rates of microorganisms in food and water at high temperatures, potentially resulting in high levels of toxins or pathogens in food (WHO, 2010).

According to what 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 foodborne illness the implementation of safe food handling practices and protection from high risk choices throughout the entire farm to – fork continuum with home food preparer being the last link in the chain and ensuring washing hands with soaps and water before preparing food which decreases the risk of foodborne diseases. The FAD recommends that hand be washed with soaps and warm water for at least 20 seconds before after handling food, especially raw meet (Cagri –Mehmetoglu,

(2009). Critical control points preventing foodborne 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 (Iossaso *et al*, 2012). Bruhn and Schutz (1998) failure to fully recognized the symptoms or source of foodborne diseases 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 factors, the error occur because consumer have not been informed about how to handle food the food safety message has not been delivered effectively (Bruhan,1997).

Although acute gastrointestinal diseases are not all food borne disease 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 diarrheal disease in developing countries are believed to be of foodborne origin also the world Health Organization (WHO) recognized that foodborne diseases include a wide spectrum of illnesses which are growing public health problem worldwide and are major contributor to illness, compromised nutritional status, less resistance to disease and loss of productivity (Tracy, 2011).

1.3. Knowledge, Attitudes and Practices (KAP):

The relationship between Knowledge, Attitudes and Practices is often explained through the (KAP). It has been traditionally assumed that knowledge is automatically translated into behavior (Glanz *et al,* 2002).

AKAP survey is a quantitative type method by interviewing through the use a structured, standardized questionnaires and statistical methods for collected information. It serves as an educational diagnosis of the community. A KAP survey is widely used to gather information through types of cross sectional surveys that planning public health programs.

The public health programs are implemented to improving the health of poor people across the world that depends upon adequate understanding of the socio –cultural and economic aspects of the context in countries (Launiala, 2009).

KAP study show that food handlers who have never trained in food safety related with poor knowledge of foodborne illness. It is a significant positive correlation between the level knowledge, attitudes and practices on food facilities. Food handlers should practice all the skills and ongoing training to get more knowledge in food hygiene and food safety (Powell *et al.*, 1997).

Knowledge accumulates through learning processes and these may be formal or informal instruction, personal experience and experience sharing (Tracy, 2011), knowledge however is not insignificant and it is found to be vital in the cognitive processing of information in the attitude- behavior relationship.

Attitude involves evaluated concepts associated with the people think, feel and behave, it comprises a cognitive, emotional and behavioral component (Keller, J. 2007).

In health related studies, however, it has been found that knowledge is not only factor that influence treatment seeking practice and in order to change behavior, health programs need to a dress a number 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.

World Health Organization (2010) 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 as safe temperature, and (5) use safe water and raw materials.

On the other hand Byr *et al.,* (2007) developed a food safety knowledge into five keys inspired by WHO (2010), which are cross contamination prevention/ disinfection procedures safe times temperatures for cooking /storing foods groups at greatest risk for foodborne diseases, and foodborne diseases pathogens.

Across sectional study Siow and Norrakiah (2011) in Malaysia to evaluate the level of knowledge attitudes and practices among food handlers. The study revealed that the respondents share a good knowledge on personal hygiene and definition of food borne disease (93.85%) and poor knowledge on food storage and preparation temperature (28%) and they showed good attitudes in food handling.

Study have found that food safety training is positively associated with self- reported changes in food safety practices (Clayton *et al.,* 2002). Other studies found that training helps to improve the overall employee knowledge about food safety *Castello et al.,* (1997).

Another study by Sufen Liu *et al.,* (2015) from China evaluated the knowledge, attitudes and practices of food safety among risk factors contributing to food borne disease outbreaks. The majority of respondents did not know the maximum stored time at room temperature, thy have positive attitudes about food safety and training, and there was significant variance among different food establishments, different ages and different times of training.

A recent study by Ola (2014) in Khartoum state showed that television and radio are the most important source of information for the consumers and there was a direct relationship between internet and the level of consumers knowledge, also degree of knowledge of each individual has storing link with his life style.

1.4. Knowledge, Attitude and Practices (KAP) on food safety and food- borne Diseases

A study to evaluate knowledge, attitude and behavior concerning food borne 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 positive attitude toward food borne disease control and preventive measures (Tracy, 2011). The positive attitude was not supported when asked about self -reported

behavior and when observed during food preparation for practices of hygienic principles (Tracy, 2011).

On other hand Abdalla *et al.,* (2009) consideration food handling personal 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 many result in food borne diseases according to (Eduarda *et al.,* 2007).

Food safety experts have identified the most common food handling mistakes made by consumer at home. These mistakes include serving contaminated raw food, cooking or heating food inadequately, allowing 12 hours or more between preparations and eating, and having colonized person handle implicated food or practice poor hygiene. The same factor were identified in mishandling associated with specific pathogens. (Burhan 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 include the perception that unsafe food is a personal health threat (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 lake of knowledge of microbiologic food hazard, refrigerator temperature ranges, cross contamination and personal hygiene (Bas *et al.,* 2006).

1.5. Best Employee Work Practices:

Establishments must ensure the facility is designed properly to provide sufficient sanitation station, tools gloves, equipment, etc., to allow the employees to properly conduct the recommended procedures. Its

important that the sanitizing process for all equipment (Knife, steel hook, etc.) is sufficient to effectively sanitize the equipment. If using hot water, then the establishment may need to leave the knife in the dip long enough to sanitize (180 F has been shown to take approximately 4-6 seconds, but this varies based on the level of contamination). Other options include adding a chemical sanitizer. Remember its important that the plan the able to demonstrate proper sanitation (Kerri and Savell *et al*, 2003).

Also the hide removal personnel must follow procedures for hand washing, cleaning of arms and gloves based on the task being performed to prevent contamination. These practices well vary based upon the task being done and should be monitored and evaluated on a routine basis (Kerri and Savell *et al*, 2003).

1.6. Impact of Education of Food industry personnel in Hygiene Matters:

Education materials may not be effective if they are designed without looking at the worksite social, physical and environmental factor surrounding the target audience. Food safety education is most likely to be effective when its designed specially for the audience (workers) and the particular hazard of interest (Nieto-Montenegro *et al*, 2005) so requires a re-examination of food safety educational messages to confirm epidemiology changing if foodborne illness and increase knowledge concerning food borne pathogens to ensure that the guidance given to consumers is appropriate controlling pathogens that are prevalent in the food supply chain (Jevsnik *et al*, 2008). Also research is needed to establish reliable and valid education measures for five behavioral

constructs which are practice personal hygiene, cook food adequately, avoid cross contamination, keep food at safe temperature, 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 food –borne illness to promote safer handling of food at the consumers end of the food chain are communication and consumer education (Patil *et al*, 2005)Educational of food industry personal in hygiene matters is recommended for improving safer food handling practices (Tracy, 2011).

Media presentation can motivate people to listen and change behavior because consumer 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 (Burhan, 1997).

Educational material regarding Good Housekeeping Practices 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

Material and Methods

3.1 Study area:

The study conducted in Al-Dilling, south Kordufan state - Sudan, from December 2018 to December 2020.

Al Dilling located at altitude of 688 m above sea level, 498 km south Khartoum, characterized by hills, mountains, and seasonal rainfall, with low and high temperature. Climate semi dry and semi humid. The area is densely population, with livestock population of cattle, sheep, goats, donkeys and poultry. The farmers in the area practice mixed crop livestock farming system.

3.2 Sample Size:

In Al Dilling about 30 restaurants, and 10 in localities around the town, and there were more street food. With approximately 6 million residents within 30 districts. First visited all communities, and randomly selected 210 participants included all communes. In each food facility, selected one customer visiting the facility after the data collected. The participants were invited to enroll in the study if they met the following criteria, visiting food facility in the period of the study, aged 15 and above, and agreed to participate in the study and after cleaning the data, 200 customers (99%) were appreciate for analysis.

3.3 Type of the Study:

The study design was a cross- sectional study which provides snapshot information on knowledge attitude and practice

Across-sectional study was conducted in Al Dilling locality on three months randomly. In each communes selected some persons to participate in the study.

3.4 Measures and Instruments:

Data were collected through face to face interviews conducted with students of Dilling University, employees, workers, and housewife, using structures of questionnaire.

The collected information consist of socioeconomic characteristics (i.e., gender, education attainment, material status, employment, and household income): habit in visiting food facilities (i.e., frequency of visiting food facility, feeling secure when eating out, and criteria when choosing facility): what customers considered the most important feature for food facility, and whether they reported to local agency when spot problems of food hygiene regulation at food facilities.

In terms of knowledge about hygienic practice of handlers in food facilities, asked customers to report their perceptions about use chopsticks/tongs/knives for raw and cooked food: and necessary of having waste basket and clean water: and hygienic requirement for them, and food handlers: and effects of cleaning food processing places or keeping food in glass cabinets.

3.5 Statistical Analysis:

The generated data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 20.0, IBM /SPSS. Frequencies were computed for all variables. Descriptive statistic were performed and analysis of variance (ANOVA). The association between knowledge about food hygiene and safety and criteria when choosing food facilities and socioeconomic information, P-value less than 0.05, were considered as statistically significant.

Chapter three

Results

Table 1 showed the most respondents were females 52.5%. Approximately more than 50% of marital status were single, indicative that the most respondents eating out, while the divorced/widow were 5%, and who married were 45%. In the Education about 34% in college/University, while illiterate and after graduate were 11%. The primary education were 17.5%, and secondary education were 13%. About 25% of them were students, and 22% were office worker, while 21% housewife, but 15% workers, and only 8% were un employments. In Household income, 60% of respondents had middle income, the poor 26%, the rich 11%, and only 2.5% were richest. About 65% were no using catering services and 35% of them were using catering services. About 65% of respondents were not feeling secure when eating out, and 36% of them were feeling secure when eating out. The respondents using street vendors were 53%. While 21.5% using other food, but 18% of them using restaurants, and just 7.5% were using fast food.

Table 3.1: demographic characteristic of customers (n=200) in Dilling city, South kordufan state- Sudan.

Table (3.1): Frequency of the respondents according to gender variable.

Gender	Frequency	Percent
male	95	47.5%
female	105	52.5%
Total	200	100%

Table 3.2: Frequency of the respondents according to marital status variable

Marital status	Frequency	Percent
single	100	50%
married	90	45%
divorced	10	5%
Total	200	100%

Table (3.3): Frequency of the respondents according to education variable

Education	**Frequency**	**Percent**
illiterate	22	11%
primary school	35	17.5%
secondary school	26	13%
high school	27	13.5%
college/university	68	34%
after graduation	22	11%
Total	**200**	**100%**

Table 3.4: Frequency of the respondents according to employment variable

Employment	Frequency	Percent
student	50	25%
worker	16	8%
office worker	42	21%
retire	6	3%
housewife	31	15%
unemployment	10	5%
other jobs	45	22%
Total	**200**	**100.0**

Table (1.5): Frequency of the respondents according to household income variable

Household income	Frequency	Percent
poor	53	26.5%
middle	120	60%
rich	22	11%
richest	5	2.5%
Total	**200**	**100%**

Table (1.6): Frequency of the respondents according to frequently using catering services variable

Frequently using catering services	Frequency	Percent
Yes	70	35%
No	130	65%
Total	**200**	**100%**

Table (1.7): Frequency of the respondents according to feeling secure when eating out variable

Feeling secure when eating out	Frequency	Percent
Yes	72	36%
No	128	64%
Total	**200**	**100.0**

Table (1.8): Frequency of the respondents according to type of current food facility variable

Type of current food facility	Frequency	Percent
fast food	15	7.5%
restaurant	36	18%
street vendor	106	53%
others	43	21.5%
Total	**200**	**100%**

Table 2. revealed that only 9.5% of respondents were using chopsticks or tongs to pick cooked food, while most 90.5 were not using chopsticks or tongs to pick cooked food. The most of respondents 73% using separate knives for raw and cooked food, while only 27% of them were not. About 93% were processing food at least 60cm from the ground, approximately 49.5% of respondents said that found positive effects of containing food in glass cabinets, and 74.5% were tested water once year.

Hygienic requirements of cooking food registered, 96.5%, 90%, 88% in people, water, and waste basket respectively.

Table 3.2: The procedures of knowledge about food hygiene and safety among customers (n=200) in food facilities in Dilling city, south Kordufan state- Sudan.

NO	The statements	Yes		NO		Mean	SD
		Freq.	%	Freq.	%		
1	Use chopsticks or tongs to pick cooked food.	181	90.2	19	9.5	1.10	0.294
2	Use separate tongs and knives for raw and cooked foods.	146	73	54	27	1.27	0.445
3	Processing food at least 60 cm from the ground.	186	93	14	7	1.07	0.256
4	Be able to list the positive effects of containing food in glass cabinets	99	49.5	101	50.5	1.51	0.501
5	Water should be tested once a year.	149	74.5	51	25.5	1.30	0.521
6	Be able to list hygienic requirements for water used for cooking.	180	90	50	10	1.10	0.301
7	Be able to list hygienic requirements for people cooking food.	193	96.5	7	3.5	1.04	0.184
8	Be able to list positive effects of cleaning or keeping hygiene in places where food is processed.	179	89.5	21	10.5	1.11	0.307
9	Be able to list hygienic requirements for a trash.	176	88	24	12	1.12	0.376
Cronbach's alpha		**0.79**					
Mean		**1.18**					
Standard deviation (SD)		**0.123**					

Table 3.3. showed that about 35%% of respondents chose food with clean and certified by the food safety authorities, and 8% of them chose the facilities with clean places for preparing food. About 18% of respondent separate raw and cooked food, 12% of them not leaving food on the ground. The people who use drugs for mouse and cockroach in the food processing place were 10%, about 42% of people chose freshness and cleanliness food as important feature, but 56.5% of them choosing a report to the local agency if finding food facilities violating food hygiene and safety regulations.

Table 3.3: The criteria of cleaning and safety regarding food facilities of customers (n=200) in Dilling city, South Kordufan state – Sudan.

NO	Statements	Male		Female		Total	
		Freq.	%	Freq.	%	Freq.	%
1	Clean facilities, with a certificate of food hygiene and safety.	40	57	30	43	70	35
2	Clean-looking facilities, no need to have a certificate of food hygiene and safety.	18	53	16	47	34	17
3	Having clean food processing places.	8	50	8	50	16	8
4	separating raw food and cooked food	18	50	18	50	36	18
5	No, leave food on the ground	13	54.2	11	45.8	24	12
6	Use drugs on mouse and cockroach killing in the food processing places.	8	40	12	60	20	10
Cronbach's alpha		**0.79**					
Mean		**2.85**					
Standard deviation		**1.767**					
The most important feature for food facilities: -							
NO	**Statements**	**Male**		**Female**		**Total**	
		Freq.	**%**	**Freq.**	**%**	**Freq.**	**%**
1	Food processing and selling during a day with good hygiene and safety.	38	45.2	46	54.8	84	42
2	Have reasonable prices.	32	43.2	42	56.8	74	37
3	Sellers have good attitudes and are professional.	17	63.4	9	34.6	26	13
4	Others.	8	50	8	50	16	8
Cronbach's alpha		**0.83**					
Mean		**1.87**					
Standard deviation		**0.926**					
reporting to the local agency if finding food facilities violating food hygiene and safety regulations:							
NO	**Statements**	**Male**		**Female**		**Total**	
		Freq.	**%**	**Freq.**	**%**	**Freq.**	**%**
1	**Yes**	48	42.5	65	57.5	113	56.5
2	**No**	47	54	40	46	87	43.5
Cronbach's alpha		**0.83**					
Mean		**1.87**					
Standard deviation		**0.926**					

Table 3.4. reveals that the total score of knowledge was focus positively associated with people who in stage of secondary education. Having specific criteria when choosing their place to eat was also factor that correlated with increase in total knowledge. Meanwhile the middle income is the mostly, and people belonging to the poorest household income quintiles tend to have lower knowledge. Moreover, those who considered food processing and selling during the day with good hygiene and safety to be the most important feature for food facilities selection also had convergent score of knowledge with those who selected reasonable prices.

Table 3.4: Factor associated with knowledge of customers regarding hygienic practices of food handlers in food facilities (n=200) in Dilling city, South Kordufan state – Sudan.

characteristics	frequency	percent
Gender		
Male	120	60.0%
Female	80	40.0%
Marital status		
Single	126	63.0%
Lives with	57	29.0%
Divorced	15	8.0%
Education		
Illiterate	20	10.0%
Primary school	46	23.0%
Secondary school	70	35.0%
High school	22	11.0%
College/University	38	19.0%
After graduation	4	2.0%
Occupation		
Workers	33	16.05%
Retirement	10	5.0%
Others	157	78.5%
Household income		
Poor	53	26.4%
Middle	120	59.7%
Rich	23	11.4%
Richest	4	2.5%

Frequency using catering service		
Yes	125	62.5%
No	75	37.5%
Feeling secure when eating out		
Yes	88	44.0%
No	99	49.5%
Depend on	13	6.5%
Type of current food		
Fast food	86	16.5%
Restaurant	114	83.5%
The most important feature		
Reasonable prices	86	43.0%
Food processing	95	47.5%
Both of them	19	9.5%
Criteria when choosing food facilities		
Clean with certificate		
No	72	64.5%
Yes	128	35.5%
Clean place		
No	5	2.5%
Yes	195	97.5%
Separating raw and cooked food		
No	5	2.5%
Yes	195	97.5%
No lave food on the ground		
No	3	1.5%
Yes	197	97.5%
Use drugs		
No	88	44.0%
Yes	112	56.0%

Hypothesis testes:

1/ test if there is a significance difference between the knowledge about food hygiene and safety and the Socioeconomic characteristics of respondents.

Table 3.5. test the difference between the knowledge about food hygiene and safety and the Socioeconomic characteristics of respondents:

hypotheses	Test	Result	Decision
Knowledge about food hygiene and safety differs according to gender.	Independent t test	T=2.201/ d.f=198/ p=0.029	Accepted
Knowledge about food hygiene and safety differs according to Marital status.	One way ANOVA	F=3.206/ d.f=5/ p=0.008	Accepted
Knowledge about food hygiene and safety differs according to Educational situation.	One way ANOVA	F=3.262/ d.f=5/ p=0.007	Accepted
Knowledge about food hygiene and safety differs according to Employment.	One way ANOVA	F=1.288/ d.f=6/ p=0.264	Rejected
Knowledge about food hygiene and safety differs according to Income.	One way ANOVA	F=0.382/ d.f=3/ p=0.766	Rejected

Table 3.5. showed that, there was significance difference between the males and females on their knowledge about food hygiene and safety because the probability value 0.029 in the independent samples test (t-test) which is less than the significance level (0.05), also there was significance difference between knowledge about food hygiene and safety and marital status among respondents, also the educational situation, because the probability value was 0.008 and 0.007 in the one way ANOVA respectively, which was less than significance level (0.05), also there was insignificance difference between the knowledge about food hygiene and safety and employment, and monthly income, because the

probability value was 0.264, 0.766 in the one way ANOVA respectively, which was greater than the significance level (0.05).

2/ The significane difference between criteria of choosing food facilities and socioeconomic characteristics of respondents.

Table 3.6. The criteria of choosing food facilities among customers and Socioeconomic characteristics of respondents:

hypotheses	Test	Result	Decision
Criteria when choosing food facilities differs according to gender.	Independent t test	T=1.143/ d.f=198/ p=0.255	Rejected
Criteria when choosing food facilities differs according to Marital status.	One way ANOVA	F=1.035/ d.f=2/ p=0.357	Rejected
Criteria when choosing food facilities differs according to Educational situation.	One way ANOVA	F=0.785/ d.f=5/ p=0.561	Rejected
Criteria when choosing food facilities differs according to Employment.	One way ANOVA	F=0.955/ d.f=6/ p=0.457	Rejected
Criteria when choosing food facilities differs according to Income.	One way ANOVA	F=3.169/ d.f=3/ p=0.025	Rejected

Table 3.6. showed that, there was insignificance difference between males and females on their criteria of choosing food facilities because the P-value was (0.255) in independent t-test which was greater than significance level (0.05), also there was insignificance difference between criteria of choosing food facilities and marital status, also educational situation and employment because the probability value was 0.357, 0.561 and 0.457 in one way ANOVA respectively, which was greater than significance level (0.05), also there was significance difference between criteria when choosing food facilities and

monthly income because the probability value was 0.025 in one way ANOVA, which was less than significance level (0.05). Chi square test value was less than Significance level (0.05), reject the null hypothesis and concluded that at (95%) confidence level that avoided of foodborne illness affliction depend on the knowledge about food hygiene and safety among customers in food facilities.

Simple correlation showed that the correlation between knowledge about food hygiene and safety and avoided of foodborne illness affliction was 0.630 which was positive and extrusive correlation. Also table 3.8. showed that the value of the adjusted coefficient of determination which used to determine the percent of the effect of independent variable on dependent variable which was 0.521 that mean 52% from changing on the dependent variable (avoided foodborne illness affliction) was caused by independent variable (knowledge about food hygiene and safety among customers in food facilities). And the complement percent 48% caused by another factors not mentioned on this study.

Chapter Four

Discussion

Personal hygiene practices investigate in this study include wearing of protective clothing, cleaning and disinfection of working clothes. This practices are considered as mandatory preventive measures which have to be implemented during the food facilities to reduce changes cross contamination (Nel *et al.*, 2004, Wambui, *et al.*, 2017).

In the present study (Table 1) the majority 52.5% of respondents were females, indicated that the most females work in cook food and food facilities, while 50% of them were single, indicated that the most of respondents eating out. About 34% were students in college/University, indicated that the most of students eating in restaurants or street food, and had good knowledge and practices of food hygiene in food facilities. This may reflect that the participants may be potentially able to understand the basic of food safety if they were trained. In household income 60% of respondents had middle income, indicative that people in Dilling city -Sudan were equal with the economic income. About 65% (table 1) were using catering services, but 64% of them not feeling secure when eating out, which indicated that there were poor hygiene practice and hygienic requirements in the food facilities. Only 9.5% of interviewed were using chopsticks or tongs to pick cooked food, this may reflect that, the chopsticks is not used and available for them. In the result (Table2) the majority of customers had good knowledge about practice with raw and cooked food, as well as environmental practice when processing food, indicated that more than 73% of customers understood the necessity of food separating kitchen cutlery for raw and ready to eat foods.

Among 200 customers (R=0.630) there were positive correlation between knowledge about food hygiene and safety among customers in food facilities and avoided foodborne illness (table 2), and there were significant difference between criteria when choosing food facilities and monthly income (P-value=0.025). Also 50.5% of respondents understand the positive effect of containing food glass cabinets, this may reflect that the people in that area need trained and courses about knowledge attitude and practice and hygienic requirements in the food facilities. In this result (Table 3) the criteria for choosing food facilities 35% of respondents were chose the cleanliness and certified by the food safety authority, while only 8% of them chose food facilities without certificate from food safety authorities. About 18% were separate of raw and cooked food, but 12% were no lave food on the ground, about 42% customers reported freshness and cleanliness of the food served as the most important feature for the food facilities. This result were comparable to the study conducted in Canada, Henson *et al* (2006).

Assessment of food safety requirements, that reported the safety of meal were predominately trait affecting the decision dining outside, while the most important feature were reported cleanliness of the kitchen, utensils, dining area and restrooms, this result in agreement with the result of Americans, Lee *et al* (2012). About 56% of customers reported back to the concerning authority when the food facilities violated in the hygiene and safety regulation. The study also found that customers, knowledge associated with hygienic practice of food handlers within food services facilities varied among different subgroup. The majority of handlers who works in the food facilities aged from 20 - 29,75 person, age from 10 – 19 was 52, and only 15 person more than 49 years old, and most of them work other jobs 78%, comparison with whom in retirement, and 59% of respondents have middle income, the richest 2.5% (table 4).

Moreover, the hygienic and safety food as the most important feature in choosing food facilities were likely to have some knowledge with people considered the reasonable prices the most, the food served and customers tended to believe their own judgment on the food safety of place of dining rather than other point of view official authorities, and 64% of respondents said that the food safety certification process essential and should focus by authority.

Conclusion

This study showed poor health status, poor hygienic practices of handlers in Al Dilling locality market and unsatisfactory awareness of KAP levels among handlers of food facilities, also underline the link between educational level and professional training on level of knowledge and personal hygiene practices regarding food facilities.

Recommendation

- Use public awareness campaigns to positively influence consumers, attitudes and practices, encouraging them to exercise caution when buying, storing, handling and preparing food.
- Should cover chilled food, dairy products, dried foods and canned food products. Moreover, special emphasis should be given to households that purchase fresh dairy products from farmers.
- Development an effective capacity building component for employees who work in consumer protection and food safety awareness and other to upgrade their skills in fields of public health and communications.
- However, a proper motivation of the workers toward maintaining a positive attitude and good practices regarding compliance with food facilities as well as enforcing all the existing laws in the country should be encouraged.

● Identified the effective approaches for the awareness campaigns to target the different socioeconomic groups and training of food handlers on food safety and hygiene practices and procedures in order to reduce the risk of possible contaminations.

● Similarly, future educational programs in the mode of spread of pathogens, zoonotic diseases and personnel in all food facilities about risk of foodborne diseases.

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Appendixes

Poor hygiene practice and requirement in the food facilities

Good hygiene practice and requirement in the food facilities

Assessment of Customers, Knowledge, Attitude and Practices of Food Hygiene and Safety Standards Among Handlers in Food Facilities in Al Dilling City –South Kordufan state (questionnaire)

Socioeconomic Characteristics of respondents

Serial No ( )

State……Locality……..

1- Gender: Male ( ), Female ( )

2- Marital status: Single ( ), Married ( ), Divorced ( )

3- Education: Illiterate ( ), Primary school ( ), Secondary school ( ), High school ( ), college⁄ University ( ), after graduate ( )

4- Employment: Students ( ), Worker ( ), Office workers ( ), Retire ( )

Housewife ( ), Unemployment ( ), Other jobs ( )

5- Frequently using catering services: Yes ( ), No ( )

6- Feeling secure when eating out: Yes ( ), No ( ), Depending on other facility ( )

7- Type of current food facility: Fast food ( ), Restaurant ( ), Street vendor ( ), other ( )

Knowledge about Food Hygiene and Safety among customers in Food Facilities

8- Use chopsticks or tongs to pick cooked food: Yes ( ), No ( )

9- Use separate knives for raw and cooked food: Yes ( ), No ( )

10- Be able to list the necessity of having trash: Yes ( ), No ( )

11- Processing food at list 60cm from the ground: Yes ( ), No ( )

12- The positive effects of containing food in glass cabinets: Yes ( ), No ( )

13- Water should be tested once year: Yes ( ), No ( )

14- Hygienic requirements for water used for cooking: Yes ( ), No ( )

15- Hygienic requirements for people cooking food: Yes ( ), No ( )

16- The positive effects of cleaning place where food is processed: Yes ( ),No ( )

17- Hygienic requirements for waste basket: Yes ( ), No ( )

Criteria when choosing food facilities among customers

18- Clean facilities, with certificate of food hygiene and safety ( )

19- Clean facilities, without certificate of food hygiene and safety ( )

20- Having clean food processing places ( )

21- Separate raw food and cooked food ( )

22- No, leave food on ground ( )

23- Use drugs on mouse and cockroach killing in the food processing places ( )

24- The most important feature in a food facility:

Food processing and selling during a day with good hygiene and safety ( )

Having reasonable prices ( )

Sellers have good attitudes and are professional ( )

Others ( )

25- Reporting to the authorities if food facilities problem in food hygiene and safety regulation: Yes ( ), No ( )

Factors associated with knowledge of customers regarding hygiene practices of food handlers in food facilities

26- Age: ( )

27- Gender: Female ( ), Male ( )

28- Marital status: Single ( ), Married ( ), Divorced ( )

29- Education: illiterate ( ), Secondary school ( )

High school ( ), college, University ( ), Post graduate ( )

30- Household income:

Poor ( ), Middle ( ), Rich ( )