Knowledge, Attitudes and Practices (KAP) of Food Handlers at Ras Al-Khaimah Poultry Company Slaughterhouse

RAK, UAE (2015)

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Date of Examination: 06/11/2015
DEDICATION

To my father....

Who,

Is no longer present in my life...

But...

I still feel his impact

Every day.
ACKNOWLEDGEMENTS

My praise and thanks be to Almighty Allah the most gracious and most merciful who granted me the mind, health, strength and patience to conduct this study.

This thesis was made possible only through the efforts of, literally dozens of people. First and for most, I wish to express my deepest gratitude and appreciation to my supervisor Prof. Mohamed Warrag for his keen supervision, intellectual simulation, skillful guidance and valuable suggestion.

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None of this work would have been completed without the moral support and encouragement of my family, mother, brothers and sisters, my wife Dr. Hanan Noah without her nothing become true and my young men Mohamed and Ahmed, a lot of thanks for their patience, loving encouragement and endless support.
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RAK, UAE, (2015)

Sami Ahmed Bakheit Abdullah

For M.Sc. in Public and Environmental Health (November, 2015)
Faculty of Health and Environmental Sciences
University of Gezira

ABSTRACT

Food-borne diseases represent a widespread and growing public health problem, both in developed and developing countries. Proper food handling can prevent spread of most foodborne diseases three important factors are playing major role in this incident. Knowledge, attitude and practice (KAP). Recently, many studies pinpoint the need for training and education of food handlers in public hygiene measures due to their lack of knowledge on microbiological food hazards, temperature ranges of refrigerators, cross contamination and personal hygiene. This study aimed to explore the knowledge, attitude and practice of food handlers in Ras Al Khaimah poultry company slaughterhouse through the methods of questionnaire and observational check list. A Self completed questionnaire was answered by 40 workers representing the total slaughterhouse staff, Results showed that the means of the percentage scores for the knowledge, attitude and practice, were 95.6%, 98.0%, 99.25%, respectively and the overall knowledge, attitude, practice (KAP) mean percentage score was 97.6 which reveal high performance. Analysis tests showed significant difference (p<0.05) between the relationship of respondents knowledge with their working experiences (p=0.000), attitudes with (p=0.000). Knowledge and attitude with educational status (p=0.000). The study revealed strong correlation between the three aspects of the study were analysis showed significant difference (p=0.000). Although this study revealed fairly high levels of knowledge, attitude and practices among the food handlers but we recommend continuation of training sessions to ensure safe food handling and raise the awareness of the food handlers towards food safety. The study also suggest that the company is in need to move from the residential area to another safe location to solve the problems of biosecurity.
تقييم المعرفة والسلوك والممارسات بين متناولي الأغذية بمسلخ شركة دواجن رأس الخيمة

رأس الخيمة، الإمارات العربية المتحدة (2015)

سامي أحمد بخيت عبد الله

ماجستير العلوم في الصحة العامة وصحة البيئة (نوفمبر، 2015م)
كلية العلوم الصحية والبيئية
جامعة الجزيرة

خلاصة البحث

الأمراض المنقولة بواسطة الغذاء تتمثل مشكلة صحية عامة واسعة النطاق ومتزايدة سواء في الدولة المتقدمة أو النامية. التعامل السليم مع الغذاء يمكن أن يمنع انتشار معظم الأمراض المنقولة بواسطة الغذاء. هناك ثلاثة عوامل مهمة تلعب دوراً رئيسياً في سلامة الغذاء وهي المعرفة والسلوك والممارسات لمتناولي الغذاء.

في الآونة الأخيرة، العديد من الدراسات اشارت الى الحاجة الملحة لتدريب وتعليم العاملين في مجال الأغذية تدابير الصحة العامة نظرًا لعدم معرفتهم ووجهتهم بشأن المخاطر الميكروباتية للغذاء، درجة الحرارة في الثلاجة، ثلث الطعام والنظافة الشخصية. هدفت هذه الدراسة إلى استكشاف وتقييم المعرفة والسلوك والممارسات لدى العاملين بمسلخ شركة دواجن رأس الخيمة من خلال الإجابة على استبانة تعبئة بواسطة العاملين بالمسلخ إضافة إلى قائمة تدقيق يقوم بها الباحث نفسه. 40 من متناولي الغذاء يمثلون جميع العاملين بالمسلخ شاركوا في البحث. تبين الاستبانة بعد التحليل كانت النسبة المئوية لمتوسط المعرفة والممارسات والسلوك هو 0.95, 98.4, 99.25 على التوالي. كما كانت النسبة المئوية لمتوسط مجموع المعرفة والسلوك والممارسة 97.6. الذي يدل على مستوى اداء عالي بين متناولي الغذاء بالمسلخ. اظهرت الدراسة كذلك فروق معنوية قوية بين الخبرة العملية والمعارف والسلوك والممارسات (P=0.05). كما ظهر ارتباط قوي بين المعرفة والممارسة (P=0.00).

كما أظهرت الدراسة علاقة طردية قوية بين محاول الدراسة الثلاثة المعرفة والسلوك والممارسة على الرغم من أن هذه الدراسة أظهرت مستويات عالية نسباً في المعرفة والمارسات والسلوك بين متناولي الأغذية. لكن الدراسة ترى أنه من المستحسن استمرار الدورات التدريبية لضمان تداول آمن للأغذية ورفع مستوى الوعي لدى متناولي الأغذية نحو سلامة الأغذية. تشير الدراسة أيضاً إلى أن الشركة تحتاج أيضاً إلى الانتقال من المنطقة السكنية الحالية إلى موقع آخر آمن من أجل حل مشاكل الأمن البيولوجي.
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ABBREVIATIONS LIST

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<td>ADFCA</td>
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</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization</td>
</tr>
<tr>
<td>FDA</td>
<td>US Food and Drug Administration</td>
</tr>
<tr>
<td>GHP</td>
<td>Good Health Practice</td>
</tr>
<tr>
<td>GMP</td>
<td>Good Manufacturing Practice</td>
</tr>
<tr>
<td>HACCP</td>
<td>Hazard Analysis Critical Control Point</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
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<td>SH</td>
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CHAPTER ONE
INTRODUCTION

1.1. Background

Food-borne diseases represent a widespread and growing public health problem, both in developed and developing countries. However, this problem has more impact on health and economy in developing countries than in developed countries but reliable data is not available (WHO, 2007). According to the World Health Organization (WHO, 2007), the global incidence of food-borne diseases is difficult to estimate. The poultry slaughterhouse is one of the major critical points with potential effects on the hygiene of poultry meat.

Protecting poultry flocks from contamination by undesirable microorganisms is an extremely important component of commercial poultry production. The introduction of a highly pathogenic, contagious disease organism into poultry flocks could result in serious economic consequences for the whole society. Developing and practicing daily bio-security procedures as best management practices on poultry farms will reduce the possibility of introducing zoonotic microbiological infections such as Salmonella and Campylobacter, as well as infectious diseases such as Avian Influenza and Newcastle disease. Poultry farmers and operators of slaughterhouses should understand the importance of, and be familiar with, the specifics of bio-security protocols and work closely to implement those programs in order to keep a consistent high bio-security level. The effectiveness of a bio-security program can be optimized if all poultry producers utilize best management practices. In modern large-scale slaughter plants, appropriate equipment is used and there are strict procedures for minimizing contamination. Nearly all procedures are automatic, and birds’ contact with surfaces or poultry workers is kept to a
minimum; for example, the carcasses are scalded in a counter-flow system, with the water flowing from clean to dirty, in the opposite direction to the birds. Automation enables the efficient control of hygiene, residues, etc. Although control systems are expensive, the large scale of operations means that this expense will have only a marginal effect on the prices of final products. These technical solutions and controls ensure delivery of a very safe product.

Unsafe food has been a human health problem since history was first recorded, and many food safety problems encountered are not new. Although governments all over the world are doing their best to improve the safety of the food supply, the occurrence of foodborne disease remains a significant health issue in both developed and developing countries (WHO, 2006). According to the World Health Organization (WHO), in 2005 alone, 1.8 million people died from diarrheal diseases and most of these cases can be attributed to contaminated food or water. In 2009, 27,037 notifications of 9 diseases or conditions that are commonly transmitted by food have been reported in Australia (The OzFoodNet Working Group, 2009). In Europe, there has also been a marked increase in reported food poisoning cases. In 2009 there were 212,064 human cases of campylobacteriosis as compared to 99,020 cases of salmonellosis (Euro surveillance editorial team, 2010).

Recently, many studies pinpoint the need for training and education of food handlers in public hygiene measures due to their lack of knowledge on microbiological food hazards, temperature ranges of refrigerators, cross contamination and personal hygiene (Bas et al., 2004; Nel et al., 2004).
1.2. Problem statement

RAPCO poultry farm suffered many challenges and biosecurity problems due to spread of the residential area and civil activities towards and around the poultry farm leading the company to stop production for six months last year and lose some of its slaughterhouse well trained food handlers, this study is targeting to investigate how the company deals with all these challenges concerning food handlers and GHP.

1.3. Objectives

1.3.1. General objectives

To assess knowledge, attitudes and practices of food handler in relation to food hygiene and safety.

1.3.2. Specific objectives

1. To assess the knowledge of food handlers on food safety.

2. To assess attitudes of food handlers towards food hygiene and food safety.

3. To assess the handling practices of food handlers concerning food hygiene and safety.

4. To check GHP and the various aspects of health requirements in the slaughterhouse.
CHAPTER TWO

LITERATURE REVIEW

Poultry meat is responsible for many zoonotic foodborne infections in the World (Alvarez-Astorga et al., 2002). Foodborne diseases have a serious impact on the public health and the economic losses due to food poisoning are in billions. During slaughter operations, inter-contamination phenomena occur, which induces proliferation of bacterial pathogens on carcasses initially healthy (INRA, 2007). Special attention must be observed in poultry meat production because of possible contamination from alimentary tracts, water, packaging, utensils and handlers (Ramasasty et al., 1999; Bryan, 2001; Nwachukwu and Nnamani, 2013).

A study on food poisoning cases reported that food handlers are responsible for foodborne disease outbreaks for the past years and there is no indication that this is diminishing (Greig et al., 2007). Proper food handling can prevent most foodborne diseases. Three important factors are playing major role in the incidence of food poisoning especially with regard to food handlers. Knowledge, attitude and practice (KAP), (Angelillo, Foresta, Scozzafava, & Pavia, 2001; Patil, Cates, & Morales, 2005). A survey among food handlers in Bangkok concluded that food handlers should attend proper training in the basic principle of food safety and rules of personal hygiene in order to improve their practices in food handling (Cuprasitrut et al., 2011). A study in the USA showed that approximately 97.0% of food borne outbreaks was due to improper food handling practices in food service fields. However, on the other hand studies have highlighted that food safety training alone was not sufficient to improve hygiene attitude and practices of food handlers (Chang et al., 2003; Walker et al., 2003). Education on food safety should be given to
all staff in food processing businesses so as to bring behavioral changes besides adoption of positive attitudes (Coleman and Roberts 2005; Powell et al., 1997). But in some previous studies no differences were detected between the staff who attended an educational course with those who did not (Angelillo et al., 2001; Askarian et al., 2004). This statement was supported by several studies (Howes et al., 1996; Powell et al., 1997) and indicates that although training may increase the knowledge of food safety; this does not always produce a positive change in food handling attitudes. Meanwhile, Ehiri and Morris (1996) pointed out that knowledge alone is not sufficient to promote positive attitudes and safe behaviors among food handlers. Therefore, alternative educational strategies, such as those based on motivational health education and promotion models are required (Angelillo et al., 2001; Askarian et al., 2004; Clayton et al., 2002). Besides knowledge, attitude is also an important factor that ensures a reduction trend of food borne diseases. Howes et al. (1996) indicates the correlation of positive behavior, attitudes and continued education of food handlers towards the maintenance of safe food handling practices. On the other hand, Bas et al. (2004) in their study found that the attitude scores of the food handlers toward food borne diseases prevention and control was poor (44.2 ± 13.2) as well as safety practice scores were very low (48.4 ± 8.8). According to Howes et al. (1996), training of managers, supervisors and all people who can influence the safety of food is essential to reduce the unacceptable high levels of food poisoning. According to Sprenger (2009), training is intended to modify or develop knowledge, skills and attitude through learning experience and to achieve effective performance in an activity or range of activities. However, the emphasis on classroom-based, foundation courses and certification in isolation has not been particularly successful in reducing levels of food poisoning. The main reason for this is the belief that
ignorance is the main reason for food poisoning (Sprenger, 2009). This observation is supported by a study carried out in Iran, where it was found that half of the food handlers interviewed were not aware that Salmonella, Staphylococcus and Hepatitis A &B viruses are major causal agents of food-borne diseases (Ansari-lari et al., 2010). Furthermore, it is assumed that if food handlers are aware of their legal obligations and they are provided with the knowledge and understanding on the prevention of food poisoning, this will automatically result in the implementation of good hygiene practices (Sprenger, 2009).

2.1. Definitions

2.1.1. Food

Food was defined as every article manufactured, sold or represented for use as food or drink for human consumption or any item that enters into or is used in the composition, preparation or preservation of any food or drink. (Food act 1983-Act 281- Malaysia)

2.1.2. Food hygiene

All conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain. (FAO/WHO, 2003).

Food hygiene is much more than cleanliness, it involves all measures necessary to ensure the safety and wholesomeness of food during preparation, processing, manufacturing, packaging, storage, distribution, handling and offering for sale or supply to the consumer (Richard, 2002).
2.1.3. Food safety

Food safety is an assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use (FAO/WHO, 2003).

Food safety describes the practice of managing food in such a way that the food is highly unlikely cause any harmful effects, whether in the short term or long term to anyone who consumes products that have been processed, stored or sold by the business (Adetok et al., 2003).

2.1.4. Good Hygienic Practices (GHP)

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

2.1.5. Micro-organisms

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

2.1.6. Food handling

Any operation in the preparation, processing, cooking, packaging, storage, transport, distribution and service of food (Codex, 2004).

2.1.7. Food handler

Any person who directly handles packaged or unpackaged food, food equipment and utensils, or food contact surfaces and is therefore expected to comply with food hygiene requirements (Codex, 2004).

A food handler may do many different things for a food business. Example include making, cooking, preparing, serving, packing, displaying and storing foods. Food handles can also be involved in
manufacturing, producing, collecting, extracting, processing, transporting, delivering, thawing, or preserving food (India Journal, 2006).

2.1.8. Food born disease

Food born disease is defined as disease of an infectious or toxic nature caused by the consumption of contaminated food or water (Taylor, 2011).

2.1.9. Contamination

The introduction or occurrence of a contaminant in food or food environment (Codex, 2004).

2.1.10. Cross contamination

Cross contamination is transfer of bacteria from one object to another. This contamination can be direct from food to food or indirect via hand and surfaces. Direct contamination requires the source of bacteria to be in direct contact with the food, for example, if raw poultry touches or drips on to high risk food. Indirect contamination relies on vehicle to transport the bacteria. For example, if raw poultry is prepared on a chopping board with utensils that are then used for high risk food (Taylor, 2010).

2.1.11. Hazard

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

2.1.12. Pests

Insects, birds, rodents and any other animal capable of directly or indirectly contaminating food (Codex, 1997).
2.1.13. Food contact surface

A surface of equipment or a utensil with, which food normally comes in to contact (ADFCA, 2008).

2.2. Food contamination

2.2.1. Microbiological contamination

Occasionally, the term "microbe" or "microbial" is used instead of the term "microorganism." Microbiological contamination means occurrence of a microorganism that has the potential to cause illness or injury. Microorganisms include yeasts, molds, bacteria, protozoa, helminthases (worms), and viruses (FDA, 1998).

2.2.2. Chemical contamination

Occurs with the contact of chemicals or chemical compounds to the food such as from Pesticides on the farm or in the food premises. And/or from industrial chemicals, Environmental contamination freezer breakdown (ammonia), mercury, fertilizers (nitrates), veterinary drugs. And/or through cleaning activities such as storage in food containers, spraying near food, Storage with food. And/or Leaching during Packaging.

2.2.3. Physical contamination

Present of foreign bodies from raw materials Such as pebbles, snails, stalks, leaves, wood, glass, insects and rodents. And/or Packaging materials Such as staples, cardboard, string, fibers, cloth, rubber, plastic, wood and polythene. And/or Structure, equipment, notices, cleaning Such as wood, nuts and bolts, plaster, paint flakes, grease/oil, glass, drawing pins, cloths and bristles. And/or from Personnel/visitors, jewellery, finger nails, buttons, combs, pen tops, sweet papers, cigarette ends and hair.
And/or from pests or rodents Such as droppings, hair, bait, insects, eggs, larvae and molts. In the food (Advanced Food Safety, 2003).

2.3. How food becomes contaminated?

Pathogenic bacteria can enter food production areas in many ways:

2.3.1. Soil/dust

Soil and dust contain many bacteria that can be brought into food production areas on vegetables, food packaging and outdoor shoes.

2.3.2. Pests/pets

Animals and pests can easily spread bacteria.

2.3.3. Water

Water from some sources can be contaminated with bacteria.

2.3.4. Raw food

Raw food (e.g. meat, poultry, fish, eggs and vegetables) is usually contaminated with bacteria.

2.3.5. Food handlers

The human body and clothes worn outside food production areas are source of bacteria.

2.4. Hygienic Practice for Poultry Processing

It applies to all premises in which poultry is slaughtered, packed, or otherwise handled in the course of preparation, and all premises in which poultry parts are processed, packed, or otherwise handled in the course of preparation. It also applies to conditions of transport from all such premises. (Codex, 1976).
2.4.1. DEFINITIONS

2.4.1.1. Slaughterhouse

A building area with special design and construction which meets certain techniques and hygiene requirements, is used as a chicken slaughterhouse for public consumption’s purpose.

2.4.1.2. Poultry

Means any domesticated bird including chickens, turkeys, ducks, geese, guinea-fowls, or pigeons.

2.4.1.3. Carcass

Means the whole of a bird after stunning, bleeding, plucking and eviscerating.

2.4.1.4. Giblets

Means the liver from which the bile sac (gall bladder) has been removed, the heart with or without the pericardial sac and the gizzard from which the lining and contents have been removed and any other material considered as edible by the consuming country, provided that all such material has been properly trimmed and washed. (Codex, 1976).

2.4.2. Raw Material Requirements

2.4.2.1. Environmental Hygiene in Raw Food Material Production Areas

2.4.2.1.1. Sanitary Disposal of Human and Animal Wastes

Adequate precautions should be taken to ensure that human and animal wastes are disposed of in such a manner as not to constitute a public health or hygienic hazard and extreme care should be taken to protect products from contamination with these wastes. All droppings, litter, scrapings, etc. from cages, crates and vehicles should be removed at least once daily. Arrangements from the disposal of trade refuse should
be approved by the appropriate official agency. A separate refuse room or other equally adequate storage facilities should be provided on the premises and should be emptied and thoroughly cleaned and disinfected at least once daily. (Codex, 1976).

2.4.2.1.2. Pest and disease control

Where control measures are undertaken, treatment with chemical, biological, or physical agents should be done only in accordance with the recommendations of the appropriate official agency, by or under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of toxic residues being retained. (Codex, 1976).

2.4.2.2. Sanitary Food Production

2.4.2.2.1. Equipment and product containers

Equipment and product containers should not constitute a hazard to health. Containers which are re-used should be of such material and construction as will facilitate thorough cleaning, and should be so cleaned and maintained as not to constitute a source of contamination to the product. (Codex, 1976)

2.4.2.2.2. Sanitary techniques

Any live poultry holding section and attendant processes such as egg collection should be quite separate from the slaughtering and poultry packing section. This applies particularly to the disposal of refuse and storage of poultry feeding-stuffs. (Codex, 1976)

2.4.2.2.3. Removal of obviously unfit materials

It is recommended that unfit birds should be segregated prior to delivery to the processing plant. Similarly, on arrival, unfit birds should be removed as soon as possible and segregated for disposal in an appropriate manner. Arrangements for removal and segregation should be approved by the official agency having jurisdiction. (Codex, 1976)
2.4.2.2.4. Protection of product from contamination

Suitable precautions should be taken to protect the birds from being contaminated by animals, insects, vermin, other birds, chemical or microbiological contaminants or other objectionable substances during handling and holding. (Codex, 1976)

2.4.2.3. Transportation

2.4.2.3.1. Facilities

Conveyances and crates for transporting the live birds from the production area should be adequate for the purpose intended and should be of such material and construction as will permit thorough cleaning and should be so cleaned, disinfected and maintained as not to constitute a source of contamination. (Codex, 1976)

2.5. Plant, Facilities, and Operating Requirements

2.5.1. Plant Registration, Construction and Layout

2.5.1.1. Registration

Plants should be approved and registered by the official agency having jurisdiction. (Codex, 1976)

2.5.1.2. Location, size and sanitary design

The building and surrounding area should be such as can be kept reasonably free of objectionable odours, smoke, dust, or other contamination; should be of sufficient size for the purpose intended without crowding of equipment or personnel; should be of sound construction and kept in good repair; should be of such construction as to protect against the entrance and harbouring of insects or birds or vermin; and should be so designed as to permit easy and adequate cleaning. Whether existing buildings are being adapted or new premises are being built, early consultation with the appropriate official agency is essential. A proper work flow is necessary to secure good hygiene standards. (Codex, 1976)
2.5.1.3. **Roadways and yards**

Roadways and yards in the immediate vicinity of and serving the premises should have a hard, paved surface which is suitable for wheeled traffic, and should have provision for thorough cleaning where necessary and adequate drainage. (Codex, 1976)

2.5.1.4. **Walls, ceilings and floors**

Walls should be finished to a smooth, non-absorbent, washable surface, be light in colour, and the junction between walls and floor should be covered or splayed to facilitate cleaning. Ceilings should be so constructed and finished as to minimize condensation, mould development, flaking and the lodgment of dirt. Floors should be of durable, impervious non-slip material, free from cracks and open joints and laid to an even surface properly sloped to an adequate drainage system. Buildings should preferably have lined roofs but where these are unlined they should be constructed and finished to minimize condensation, mould development, flaking, and dirt, in order to protect against contamination of the product. (Codex, 1976)

2.5.1.5. **Woodwork, doors, and windows**

Woodwork should preferably not be used. If its use is unavoidable it should be kept to a minimum, be of simple design, easy to clean, and be tight fitting to wall surfaces. Doors and jambs should, where necessary, be fitted on both sides with non-corroding metal or other suitable materials as a protection from impact damage, and doors where necessary should be fitted with self-closing devices. All external openings and doors and openable external windows should be equipped to exclude flying insects, where these present a problem. Windowsills should be splayed at an angle. (Codex, 1976)
2.5.2. Sanitary Facilities and Controls

2.5.2.1. Separation Processes

Areas where birds are received or stored should be so separated from areas in which final product preparation or packaging is conducted as to preclude contamination of the finished product. Areas and compartments used for storage, manufacture or handling of edible products should be separate and distinct from those used for inedible materials. The food handling area should be completely separated from any part of the premises used as living quarters. (Codex, 1976)

2.5.2.2. Water supply

An ample supply of both hot and cold water should be available of the potable quality referred to in the General Principles of Food Hygiene (CAC/RCP 1-1969), Sections 4.3.12 The water used during the preparation, handling, packing and storing of poultry carcasses, poultry parts and other edible material should be potable. Samples of the water should be taken regularly and tested for conformity with the bacteriological and chemical standards. (Codex, 1976)

2.5.2.3. Ice

Ice should be made from water of potable quality and should be manufactured, handled, stored and used, so as to protect it from contamination. (CAC/RCP 14-1976)

2.5.2.4. Auxiliary water supply

Where non-potable water is used - for such purposes as fire control - it must be carried in completely separate lines, identified preferably by colour and with no cross-connection or back siphonage with the lines carrying potable water. (Codex, 1976)
2.5.2.5. Plumbing and waste disposal

All plumbing and waste disposal lines (including sewer systems) must be large enough to carry peak loads. All lines must be watertight and have adequate traps and vents. Disposal of waste should be effected in such a manner as not to permit contamination of potable water supplies. The plumbing and the manner of waste disposal should be approved by the official agency having jurisdiction. Sumps or solid matter traps included in the drainage system within the plant should be emptied and cleaned frequently and at the end of every working day. Every inlet into the drainage system should be trapped and no drain ventilation pipe should open into any room. Any internal open channelling should be rounded and of sufficient width to allow for easy cleaning, and of minimum efficient depth. Covering grids should be easily removable for cleaning. Channels should be flushed frequently during processing and thoroughly cleaned at least once daily. (Codex, 1976)

2.5.2.6. Lighting and ventilation

Premises should be well lit and ventilated. Special attention should be given to the venting of areas and equipment producing excessive heat, steam, obnoxious fumes or vapours or contaminating aerosols. Good ventilation is important to prevent both condensation (which may drip into the product) and mould growth in overhead structures - which growth may fall into the food. Light bulbs and fixtures suspended over food in any step of preparation should be of the safety type or otherwise protected to prevent food contamination in the case of breakage. Lighting should have an overall intensity of not less than 325 Lux (30 foot candles), and in inspection areas this should be increased to no less than 540 Lux (50 foot candles), should not affect colours and be properly directed onto the bird. (Codex, 1976)
2.5.2.7. **Toilet-rooms and facilities**

Adequate and convenient toilets should be provided and toilet areas should be equipped with self-closing doors. Toilet rooms should be well lit and ventilated and should not open directly into a food handling area. They should be kept in a sanitary condition at all times. There should be associated hand-washing facilities within the toilet area and notices should be posted requiring personnel to wash their hands after using the toilet. (Codex, 1976)

2.5.2.8. **Hand-washing facilities**

Adequate and convenient facilities for employees to wash and dry their hands should be provided wherever the process demands. They should be in full view of the processing floor. Single-use towels are recommended, where practicable, but otherwise the method of drying should be approved by the official agency having jurisdiction. The facilities should be kept in a sanitary condition at all times. Hand washing facilities in workrooms should not be capable of being operated by hand. (Codex, 1976)

2.5.2.9. **Accommodation for clothing and footwear**

Suitable and sufficient accommodation for keeping clothing and footwear not worn during working hours should be provided. Such accommodation should be separate from any processing room. (Codex, 1976)

2.6. **Equipment and Utensils**

2.6.1. **Materials**

All food contact surfaces should be smooth; free from pits, crevices and loose scale; non-toxic; unaffected by food products; and capable of withstanding repeated exposure to normal cleaning; and non-absorbent unless the nature of a particular and otherwise acceptable process renders the use of a surface, such as wood, necessary. (Codex, 1976)
2.6.2. Sanitary design, construction and installation

Equipment and utensils should be so designed and constructed as will prevent hygienic hazards and permit easy and thorough cleaning. Stationary equipment should be installed in such a manner as will permit easy and thorough cleaning. Suitable, easily accessible equipment for the cleaning and disinfection of hand tools by means of hot water should be provided in workrooms. Equipment and utensils used for condemned, inedible or contaminating materials should be so identified and should not be used for handling edible products. Processing equipment and utensils used for slaughtering and packing should be used for these purposes only. (Codex, 1976)

2.6.3. Bleeding and blood collection

Bleeding equipment, including blood tunnels and blood containers, should be constructed of non-corrodible metal or other suitable material which is easy to clean. They should be thoroughly cleaned after major breaks during working periods and at the end of the day. Blood tunnels which are of solid wall construction should be properly tiled or otherwise smooth surfaced with impervious material, suitably drained, and of sufficient width and construction as to facilitate thorough cleaning. Metal tunnels should be fitted with side and head shields easily removable for cleaning and the base trough should have a suitable fall to a blood container which can be easily emptied and cleaned. (Codex, 1976)

2.6.4. Processing equipment

2.6.4.1. Scalding

Should preferably be carried out by more hygienic methods than by the use of scalding tanks. When scalding tanks continue to be used, particular care should be taken to ensure that hygienic standards are as good as possible. The rate of flow of water into these tanks should
provide for a continuous replacement of the water so as to protect against a build-up of contamination and preferably, where practicable, in such a way that the water flow should be in the opposite direction to that in which poultry is travelling, so that the scalded poultry is pulled out on that side of the scalding tank on which clean hot water enters the tank. Tanks should be emptied at regular intervals and at least once every working day. Scald agents where used, should be approved by the official agency having jurisdiction. (Codex, 1976)

2.6.4.2. Plucking machines

Should be designed to control the scatter of feathers as much as possible. The removal of feathers from the site should preferably take place continuously or as often as necessary, throughout the working day. Feathers should be stored in suitable clean containers which should be removed at least once daily. Feathers conveyed by continuous running water should be removed from the water which should preferably be run to waste. (Codex, 1976)

2.6.4.3. Perforated metal drainage surfaces

Should be reversible for cleaning purposes. (Codex, 1976)

2.6.4.4. Evisceration troughs

Should be constructed of stainless steel or other suitable material. The main water flow should be in the opposite direction to that in which carcasses are travelling so that the carcass arrives for cooling at the point where clean water enters the trough. Additionally, trickle jets of clean water should be provided along both sides of the trough, and supplies of running warm water should also be provided over the troughs for hand rinsing. The troughs should be arranged to limit the travel of inedible material by the insertion of outlets and containers at strategic points in addition to the main outlet. The number and placing of the outlets should prevent build-up of material in the troughs and should be commensurate
with the rate of flow of production, the design of equipment and other relevant variable factors. Particular attention should be paid to the provision of adequate outlets where the trough is longer than 10 meters. (Codex, 1976)

2.6.4.5. Storage containers

For inedible material should be leak-proof, constructed of metal or other suitable impervious material which is easy to clean, and be covered with close-fitting lids. Where chutes or other continuous disposal methods are used they should be so constructed as to protect against contamination or offensive odours. (Codex, 1976)

2.6.4.6. Storage premises

Premises where poultry carcasses, poultry parts, and other edible material are kept should have adequate refrigerated storage. (Codex, 1976)

2.6.4.7. Chilling equipment

Equipment used for chilling the carcasses and edible material should be constructed of stainless steel or other suitable material and should be so operated as to protect against the build-up of microorganisms. Spin chillers and other processes of chilling in a common tank, when their use is not prohibited by national legislation, should be operated in accordance with the requirements established by the official agency having jurisdiction. (Codex, 1976)

2.7. Hygienic Operating Requirements

2.7.1. Sanitary maintenance of plant, facilities and premises

The building equipment, utensils and all other physical facilities of the plant should be kept in good repair and should be kept clean and maintained in an orderly sanitary condition. Waste materials should be
frequently removed from the working area during plant operation and adequate waste receptacles should be provided. Detergents and disinfectants employed should be appropriate to the purpose and should be so used as to present no hazard to public health. (Codex, 1976)

**2.7.1.1. Operations supervision**

These operations should be under the supervision of an appropriately qualified person, approved by the official agency having jurisdiction. (Codex, 1976)

**2.7.1.2. Cleaning routine**

Premises, equipment and utensils should be cleaned at frequent intervals during the day. They should be cleaned and disinfected, immediately and thoroughly, whenever circumstances demand it, such as when they have been in contact with diseased or infected materials. Additionally, they should be cleaned and disinfected at the end of each working day. The premises should be cleared of all live poultry at least once weekly to facilitate complete and thorough cleansing. Birds should normally be slaughtered within 24 hours of arrival and any water fed to them should be of potable quality. (Codex, 1976)

**2.7.1.3. Blood and feathers removal**

To avoid the risk of cross-contamination, blood and feathers should be kept away from the plucked poultry as they go on for the next stage of processing.

**2.7.1.4. Isolation of the processes**

Each process should be carried out in its own clearly defined area. (Codex, 1976)

**2.7.1.5. Plucked poultry**

Poultry which is received rough plucked for the next stage of processing, should be hung singly or arranged in single layers on racks or similar type of equipment. (Codex, 1976)
2.7.1.6. Crop contents and fecal materials

Feed in the crop and fecal material in the cloaca should be removed by such means as will protect against contamination; for example, by suction. (Codex, 1976)

2.7.2. Vermin control

Effective measures should be taken to protect against the entrance into the premises and the harborage on the premises of insects, rodents, birds or other vermin. (Codex, 1976)

2.7.3. Exclusion of domestic animals

Dogs, cats and other domestic animals should be excluded from areas where food is processed or stored. (Codex, 1976)

2.7.4. Hygiene and health of personnel

2.7.4.1. Employee training

Managers of establishments should arrange for adequate and continuing training of every employee in hygienic handling of poultry and clean habits so that the employees are able to take the necessary precautions to prevent contamination of poultry. (Codex, 1976)

2.7.4.2. Medical examination

It is recommended that national legislation should provide for a medical examination of poultry handlers, and inspectors and other persons who come into contact with poultry in establishments. This medical examination should be carried out just prior to employment and should be repeated when clinically or epidemiologically indicated. The medical examination should pay particular attention to 1) infected wounds and sores; 2) enteric infections including parasitic diseases and carrier states, especially with respect to Salmonellae; and 3) respiratory diseases. (Codex, 1976)
2.7.4.3. Health problems

The management should take care to ensure that no employee, while known or suspected to be suffering from or to be a carrier of a disease capable of being transmitted through poultry, or while afflicted with infected wounds or sores or diarrhoea, is permitted to work in any area of an establishment in a capacity in which there is a possibility of such a person directly or indirectly contaminating poultry with pathogenic microorganisms. Any persons so affected should immediately report to management that they are ill. (Codex, 1976)

2.7.5. Toxic substances

All rodenticides, fumigants, insecticides or other toxic substances should be stored in separate locked rooms or cabinets and handled only by properly trained personnel. They should be used only by or under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of contamination of the product. (Codex, 1976)

2.7.6. Personnel hygiene and food handling practices

2.7.6.1. Personal cleanliness

All persons working in a food plant should maintain a high degree of personal cleanliness while on duty. Personnel working with live birds, feeding stuffs or unfit materials should not be permitted in other sections of the premises where poultry is being processed unless adequate cleansing measures are taken by such personnel to prevent contamination. Clothing including suitable head-dress should be appropriate to the duties being performed and should be kept clean. (Codex, 1976)

2.7.6.2. Hands washing

Hands should be washed as often as necessary to conform to hygienic operating practices. (Codex, 1976)
2.7.6.3. Prohibited acts and bad habits

Spitting, eating, chewing and the use of tobacco should be prohibited in food handling areas. (Codex, 1976)

2.7.6.4. Necessary precautions

All necessary precautions should be taken to prevent the contamination of the food product or ingredients with any foreign substance. (Codex, 1976)

2.7.6.5. First aid facilities

Minor cuts and abrasions on the hands should be appropriately treated and covered with a suitable waterproof dressing. Adequate first-aid facilities should be provided to meet these contingencies so that there is no contamination of the food. (Codex, 1976)

2.7.6.6. Gloves type

Gloves used in food handling should be maintained in a sound, clean and sanitary condition; gloves should be made of an impermeable material except where their usage would be inappropriate or incompatible with the work involved. (Codex, 1976)

2.8. Operating Practices and Production Requirements

2.8.1. Inspection and sorting

2.8.1.1. Processing of different types of birds

To protect against the risk of cross contamination, domesticated birds including chickens, turkeys, ducks, geese, guinea-fowl, or pigeons should be processed completely separate from one another either in time or place. Where the separation is one of time the processing areas should be cleaned thoroughly before the introduction of a different species of bird to the processing area. Workers employed with live birds, feeding-stuffs or unfit materials should not be permitted to work in parts of the premises where poultry is slaughtered or processed, unless adequate
cleansing measures are taken by such personnel to prevent contamination. (Codex, 1976)

2.8.1.2. Ante-mortem and post-mortem inspection

In order to maintain good hygienic conditions and to prevent hazards to the consumer, all poultry should undergo ante-mortem and post-mortem inspections which should be carried out by the appropriate official agency, under veterinary supervision. (Codex, 1976)

2.8.1.3. Unfit and suspected poultry

Independent of ante-mortem and post-mortem inspection procedures, it is recommended that unfit poultry or poultry suspected of disease be removed and segregated in order that they may be inspected by the official agency having jurisdiction and thereafter disposed of in an appropriate manner in order to prevent the spread of disease. (Codex, 1976)

2.8.1.4. Unfit poultry parts

Poultry carcasses, poultry parts and other normally edible materials found to be unfit for human consumption should be kept in a separate room and removed at least once a day. The room should be lockable and the carcasses, parts or other materials should be held there securely. Arrangements for such retention and for disposal generally should be approved by the official agency having jurisdiction. (Codex, 1976)

2.8.2. Washing or Other Preparation

After evisceration and inspection carcasses should be washed. (Codex, 1976)

2.8.3. Preparation and Processing

2.8.3.1. Preparatory operations

Preparatory operations leading to the finished product and the packaging operations should be so timed as to permit expeditious handling of consecutive units in production under conditions which
would prevent contamination, deterioration, spoilage or the development of infectious or toxigenic microorganisms. (Codex, 1976)

2.8.3.2. Temperatures, cooling and freezing procedures

Temperatures and procedures which are necessary for cooling and freezing carcasses and all edible portions thereof, should be in accordance with operating practices which ensure the prompt removal of the animal heat and preserve the condition and wholesomeness of the carcasses and all edible portions thereof. (Codex, 1976)

2.8.3.2.1. General cooling requirements

After preparation there should be no delay in cooling the carcass to an internal body temperature of 4°C (39°F) or less. Where cutting up takes place before cooling to 4°C (39°F), it should be carried out within one hour of slaughter: immediately after cutting the temperature of the parts should be reduced to 4°C (39°F) or less. Where cutting up takes place after cooling to 4°C (39°F), the internal temperature of the carcass and parts shall not be allowed to exceed 10°C (50°F), in as far as this temperature is approved by the controlling authority which shall nevertheless ensure that necessary measures are taken to control microbiological growth. (Codex, 1976)

2.8.3.2.2. Cooling giblets

Giblets should be chilled to 4°C (39°F) or lower within 2 hours from the time they are removed from the bird. (Codex, 1976)

2.8.3.2.3. Refrigeration

The temperature in the storage area where non-frozen poultry carcasses, poultry parts and other edible materials are kept should be 4°C (39°F) or less. Poultry carcasses, poultry parts, and other edible material should be so stored that they are protected against deterioration and mould growth. They should be regularly inspected and dispatched in strict rotation. Cold rooms used for bulk storage should preferably be
fitted with automatic defrosting equipment. Care should be taken to avoid the transference of dirt into the rooms. Non-frozen poultry carcasses, poultry parts and other edible material should be transported at 4°C (39°F) or less. (Codex, 1976)

2.8.3.2.4. Preservation by freezing

Carcasses, poultry parts, and other edible material which are intended for preservation by freezing, should be frozen as soon as possible and should not be held chilled for more than 72 hours. (Codex, 1976)

2.8.3.2.5. Ice-pack containers

When poultry carcasses are ice-packed in barrels or other containers, they should preferably be wrapped in plastic or other suitable material to protect against contamination. The barrels and containers should be covered and should have an adequate number of drain holes to permit the water to drain out. Wooden barrels or containers should not be used for this purpose. (Codex, 1976)

2.8.4. Packaging of finished product

2.8.4.1. Materials

Packaging materials should be stored in a clean and sanitary manner and should not transmit to the product objectionable substances beyond limits acceptable to the official agency having jurisdiction and should provide appropriate protection from contamination. (Codex, 1976)

2.8.4.2. Techniques

Packaging should be done under conditions that preclude the introduction of contamination into the product including separate wrapping of giblets. (Codex, 1976)
2.8.5. Preservation of finished product

Methods of preservation and necessary controls should be such as to protect against contamination, infestation, or development of a public health hazard and against deterioration within limits of good commercial practice. (Codex, 1976)

2.8.6. Storage and transport of finished product

The finished product should be stored and transported under such conditions as will preclude the contamination with or development of pathogenic or toxigenic microorganisms or infestation and protect against deterioration of the product or of the container. (Codex, 1976)

2.9. Hygiene Control Program

It is desirable that each plant in its own interest designate a single individual, whose duties are preferably divorced from production, to be held responsible for the cleanliness of the plant. The staff should be a permanent part of the organization and should be well trained in the use of special cleaning tools, methods of disassembling equipment for cleaning, and in the significance of contamination and the hazards involved. Critical areas, equipment and materials should be designated for specific attention as part of a permanent sanitation schedule. (Codex, 1976)

2.10. Laboratory Control Procedures

In addition to any control by the official agency having jurisdiction, it is desirable that each plant in its own interest should have access to laboratory control of the sanitary quality of the products processed. The amount and type of such control will vary with the food product as well as the needs of management. Such control should reject all foods that are unfit for human consumption. Analytical procedures used should follow recognized or standard methods in order that the results may be readily interpreted. (Codex, 1976)
2.11. End-product specifications

Appropriate methods should be used for sampling, analysis and determination to meet the following specifications:

(1) To the extent possible in good manufacturing practice, the product should be free from objectionable matter. Poultry carcasses, poultry parts and other edible materials should not contain residues of hydrogen peroxide, natural or artificial colouring matter, substances used to remove colour, antibiotics, preservatives, tenderizers, or flavouring substances.

(2) The products should comply with the requirements set forth by the Codex Alimentarius Commission Committees on Pesticide Residues and Food Additives and Contaminants contained in permitted lists or relevant Codex commodity standards. (Codex, 1976)

2.12. Personal hygiene of the food handler

The human body is a source of many pathogens. The nose, throat, hands and faeces are the most important sources. Therefore, personal hygiene, protecting clothing and hand washing play an important role in preventing disease. Thorough hand washing will take approximately 20 seconds. It must include the following steps:

a) Wet, warm water should be applied to both hands

b) Lather, soap should be applied and hands should be rubbed together to make a lather. All surfaces of both hands should be covered.

c) Rinse, all soap should be rinsed away with fresh clean water.

d) Dry, hands should be dried thoroughly, ideally with a clean paper towel.

Habits, not allowing during food handling, such as smoking, tasting food using fingers or other activities which bring hands and mouth directly in contact with food, because these habits can cause contamination of food, equipment and surfaces with pathogens from body (Taylor, 2011).
The following Table summarizes food handling practices essential to produce safe food:

**Essential food Handling Practices**

<table>
<thead>
<tr>
<th>Area</th>
<th>Action</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.Protective clothing</td>
<td>Clean, washable protective clothing should be worn in food premises</td>
<td>Contamination from outdoor clothing can spread to food, surfaces and equipment</td>
</tr>
<tr>
<td>2.Shoes</td>
<td>Work-hall shoes should be worn exclusively for food duties and not outside</td>
<td>Outdoor shoes can carry contamination into kitchen; spores are found commonly in soil</td>
</tr>
<tr>
<td>3.Jewellery</td>
<td>Rings, watches, bracelets, etc. should not be worn</td>
<td>Jewelers traps grease, dirt and bacteria. Also, it encourages the touching of hands, arms and neck, which increases the risk of contamination by pathogens from skin</td>
</tr>
<tr>
<td>4.Hands</td>
<td>Hands should be washed thoroughly when required: for example when visiting the toilet, after handling raw foods and before handling ready-to-eat food</td>
<td>Direct skin contact can contaminate food with pathogens from the body, raw food, etc.</td>
</tr>
<tr>
<td>5.Nails</td>
<td>Nails should be kept short and clean. Nail varnish should not be use</td>
<td>Food can be exposed to pathogens trapped under nails. Varnish obscures the cleanliness of nails</td>
</tr>
<tr>
<td>6.Hair</td>
<td>Hair should be entirely enclosed</td>
<td>Hair can physically contaminate food, also hair contain many microbes</td>
</tr>
<tr>
<td>7.Cuts/Boils</td>
<td>Cuts and abrasions should be cover with waterproof dressings. Food handlers with septic cuts/boils on the hands should not handle food. Cuts and abrasions should be</td>
<td>Infected skin contains large doses of Staphylococcus aureus. Antiseptic will make conditions unsuitable for further growth of microbes.</td>
</tr>
</tbody>
</table>
treated with antiseptic cream.


2.13. Common bad practices
- Wetting fingers to open bags or to pick up sheets of wrapping paper.
- Picking the nose.
- Scratching the head or spots.
- Tasting food with un washed spoon.
- Coughing and sneezing on to hands and handling foods without first washing.
- Using a foods sink for hand washing.
- Using a wash hand basin to rinse utensils.
- Handling the inner parts of crockery or glass.
- Chewing gum, eating food or sweets in food rooms others than dining areas (Park, 2009; Richard, 2002; Charmaine et al., 2005).

2.14. Food borne diseases

Food borne illnesses of microbial origin has been identified as the most serious food safety problem (Aimmees and Pragk, 2004).

Surveillance data collected in the United States confirms that large food borne diseases out breaks of salmonellas, Hepatitis, Norovirus and E.coli 0157 infection are on the rise (Aimmees and Pragk, 2004).

Food worker behaviors and practices in food service establishment have been epidemiologically linked to repeated food borne illnesses (Aimmees and Pragk, 2004).
2.14.1. Most common food borne diseases/food poisoning microorganism

2.14.1.1. *Campylobacter*

There are several forms of the *Campylobacter* spp. The most common is *Campylobacter jejuni*, which accounts for approximately 99% of all infections.

The epidemiology differs from *Salmonella* in that *Campylobacter* does not multiply on food and secondary infection is rare.

The most common food source of *Campylobacter* is poultry meat and around 50% of chickens are believed to carry *Campylobacter* spp. It infects the human intestinal tracts and sometimes the bloodstream. Cases often occur during the summer months, the peak is in May (Jeremy, 2007).

Sickness occurs when undercooked chicken is eaten, or the organisms are transferred to the mouth inadvertently during cooking. Unpasteurized milk and untreated water can also pass on *Campylobacter*. Milk from bottles pecked by birds should never be consumed. 10% of infections reported in the UK are acquired whilst abroad, and *Campylobacter* can be passed on by contact with infected dogs and cats.

Campylobacter bacteria cause gastro-enteritis, characterized by bloody diarrhea, fever and abdominal cramps. The illness typically lasts 5 to 7 days and is usually resolved without antibiotics. Deaths are rare, with only one or two reported cases year. However Campylobacter infections can provoke a paralysing neurological illness called Guillain Barre Syndrome in a small percentage of cases. Infected people continue to pass the organism in their faeces for up to a week (Jeremy, 2007).
2.14.1.2. *E.coli 0157: H7*

Is a bacterial pathogen that has a reservoir in cattle and other similar animals? Human illness typically follows consumption of food or water that has been contaminated with microscopic amounts of cow feces. The illness it causes is often a severe and bloody diarrhea and painful abdominal cramps without much fever. In 3% to 5% of cases a complication called hemolytic uremic syndrome can occur several weeks after the initial symptoms. This severe complication includes temporary anemia, profuse bleeding and kidney failure (Food borne illness, 2005).


Salmonella is a Gram-negative, non-spore forming, short rod-shaped bacterium which is widely distributed in humans and animals. Their effects can vary widely and there are nearly 3,000 known serotypes. Salmonellae can be classified into three principal groups:

a) Those that infect only people and which can be transmitted through food, e.g. *Salmonella Typhi* and *Salmonella Paratyphi*;

b) Host-adapted strains, some of which are human pathogens and which can be transmitted by food, e.g. *Salmonella dublin*;

c) Certain strains which do not have a particular host, but which may have pathogenic effects on people and animals.

The most common causes of food poisoning are those associated with *Salmonella Typhimurium* and *Salmonella Enteriditis* which result in the condition known as ‘salmonellosis’ The symptoms include sickness, fever, diarrhea and severe abdominal pain lasting as long as seven days in some cases. A person suffering from salmonellosis excretes the bacteria in the faeces and may transmit the disease to others.

Salmonellae multiply quickly at a temperature between 7°C and 45°C and the route of infection is through raw animal products, such as milk, poultry, eggs and egg-based products and raw meat. They can also be
carried on insects, rodents, birds and animal pets, together with water and sewage. Prevention of infection is based on the maintenance of high standards of personal hygiene, thorough cleaning and disinfection of food processing areas (Jeremy, 2007).

2.14.1.4. Staphylococcus aureus

This micro-organism is found commonly on the human body, in the ear, nose and throat, and in septic skin lesions, such as boils, pimples, whitlows, burns and cuts. *Staphylococcus aureus* produces exotoxins and the foods most commonly associated in food poisoning outbreaks are poultry, ham, dairy products, raw milk and egg products.

Contamination is commonly associated with poor personal hygiene, infected food handlers contaminating food, inadequate temperature control, preparation of food too far in advance of serving, resulting in high risk foods standing at ambient temperatures, and inadequate temperature control of food during processing (Jeremy, 2007).

2.14.1.5. Listeria monocytogenes

This bacterium has been found in most farm animals, poultry and domestic pets, wild birds, insects, soil, sewage and decaying vegetable matter. The more vulnerable members of society, e.g. young children, pregnant mothers, the elderly and the sick are most at risk of contracting the disease known as Listeriosis.

As such, Listeria is resistant to heat, drying and freezing, and is capable of growth in a refrigerator if the temperature consistently exceeds 5°C.
Listeriosis has been associated with a range of foods, such as raw and smoked fish, milk, ice cream, pates, cooked meats, full-fat soft cheeses, such as Camembert and Brie, prepared salads and sandwiches. Measures to prevent listerial growth include:

- Thorough reheating of foods to a core temperature of at least 70ºC
- Ensuring cook-chill products are consumed well within the ‘use by’ date
- Frequent defrosting of refrigerators
- Washing of salad foods (Jeremy, 2007).

**2.14.1.6. Bacillus cereus**

This is an organism commonly found in cereals, vegetables, dairy products and soil, and which causes two types of illness associated with different enterotoxins, namely vomiting illness and diarrheal illness. Bacillus cereus is a Gram-positive aerobic spore-forming bacterium which causes food poisoning through the release of an exotoxin.

Symptoms of vomiting illness arise very quickly and are similar to those of *Staphylococcus aureus* food poisoning with acute vomiting and, in some cases, diarrhea.

Foods associated with vomiting illness include cereals, such as boiled rice, but eaten cold as in the case of salads, fried rice and corn flour. Pasta, certain cheese products and potatoes have also been shown to be carriers of this micro-organism.

In the case of diarrheal illness, the mild symptoms resemble those of *Clostridium perfringens* food poisoning including diarrhea and abdominal pain, sometimes with vomiting and nausea. Fish, milk, vegetables and meat are typical carriers of this micro-organism (Jerem, 2007).
2.14.1.7. *Clostridium perfringens*

This anaerobic bacterium is commonly associated with meat and meat dishes, such as rolled joints of beef, stews and other meat dishes which have gone through a long slow cooking and storage process. Where they have not been cooled rapidly or refrigerated after cooking, or where they have not been reheated thoroughly, the risk of infection can be significant. Contamination may be from excreta, raw meat and poultry and from soil. The disease has been associated in the past with institutional cooking arrangements, such as in hospitals, schools, factory canteens and prisons, where large quantities of food are prepared many hours before service and kept below a recognized hot holding temperature.

*Clostridium perfringens* is a spore-forming bacterium which often survives normal cooking and food poisoning symptoms arise as a result of an enterotoxin released during spore formation in the digestive system. Growth takes place between 15ºC and 50ºC and it usually requires an extremely large number of the organism to be present in the food for food poisoning, which is relatively mild, to occur. The onset period for the disease is 8 to 22 hours with duration of illness between 12 to 48 hours. Symptoms include abdominal pain, diarrhea, occasional vomiting and nausea (Jeremy, 2007).

2.14.2. Some common diseases, occasionally food borne

Some common diseases are occasionally food born, even though they are transmitted by other routes. These include infections caused by *shigella*. Hepatitis A, and the pararities, *Giardia lamblia* and *Cryptosporidium spp.* Even *Streptococcus spp.* throats have been transmitted occasionally through food (Food borne illness, 2005).
2.14.3. Diseases caused by the present of toxin

Toxin in the food was produced by a microbe, for example, the bacterium *Staphylococcus aureus*, the rare but deadly disease *botulium* grows and produces a powerful paralytic toxin in food (Food borne illness, 2005).

2.15. Health education in food safety

The strategy for preventing food borne illnesses can be described in terms of three lines of defence; improvement of the hygienic quality of raw stuff in agriculture, and aquaculture, application of food processing technologies that control contamination and education of food handless and consumers (WHO, 2000).

The third line of defence-the education of food handlers and consumers in the hygienic handling food-is crucial in preventing food borne illnesses and will be effective even the other two defence fail. As the preparation of food for consumption is at the end of the food chain. It is a critical stage. (Fischer *et al.*, 2006; WHO, 2000).

2.16. Training

Food business operators involved in the food chain shall ensure that all staffs are trained (ADFCA, 2008).

Different stages will be needed for different food handlers. Three categories of food handlers (A, B and C) are described who must be supervised and instructed and/or trained. Other staffs who are not food handlers may need some instruction or training as a matter of good practice. The training needed will relate to the actual job of the individual. It will also relate to the type of food that they handle. Staffs who handle ‘high risk’ food will need more training than those who handle ‘low risk’ foods. As a matter of good practice trainers themselves should be adequately trained.
Effective food safety training involves two stages; the first stage is the provision of knowledge in a way that develops understanding and positive attitude, for example, the importance of hand washing and the knowledge when to wash the hands. The second stage involves the implementation of his knowledge, by washing the hands properly when required. Practice, motivation and effective supervision, especially coaching, should result in the objective being achieved, is the competency of the food handler and implementation of good practice at all times (Richard, 2002).

CHAPTER THREE
MATERIALS AND METHODS

3.1. Study area

The study was carried out in Ras Al Khaimah poultry company (RAPCO) which is located in emirate of Ras Al Khaimah – UAE (map). RAPCO is a leading poultry company in UAE, It was established during 1976 in Digdaga town-Ras Al Khaimah as first and big modern company which cover all the country with eggs and poultry meat. Digdaga area now show increased and progressive growth in the residential area which now approaches the production units of the company and poses a lot of threat to the poultry farms biosecurity. Also the area show increased number in farms producing date and raising different type animals and birds, also camel race area lie in the vicinity of the company farms which make the continuation of the company in its place on the discussion table.
3.2. Study population

The study population consists of forty (40) food handlers in the RAPCO slaughterhouse comprising all of the company staff found during study period.

3.3. Study design

The study was designed as descriptive case study utilizing different dependent and independent variables which are knowledge, attitude and practice plus the demographic characteristics of the respondents.

3.4. Sampling

3.4.1. Sample size

This study covered all food handlers at company slaughterhouse, a total of 40 food handlers were considered in this study as a sample.

3.5. Data collection

The Data was collected by two methods.
A - Questionnaire

A Questionnaire was (see Appendix) containing the following sections.

1- Socio- demographic characteristics of the food handlers.
2- Knowledge of the Food handlers.
3- Attitude of the Food Handlers.
4- Practices of the food handlers.

B- Observations check list

Checklist designed to check the Company slaughterhouse, to check the various aspects of hygiene and health including the fitness of the food handlers and the application of the requirements of health, and other factors that may lead to food contamination in the area. GHP and GMP in the facility.

This Checklist mobilized by a researcher to ensure the accuracy

3.6. Data processing and analysis

Data were processed and analyzed by the computer using Statistical Package for Social Science (SPSS) version 16.
CHAPTER FOUR
RESULTS

The data were collected from the food handlers through the methods of questionnaire and observational checklist for the slaughterhouse and analyzed using the SPSS version 16.0.

4.1. Results

A Total of 40 food handlers comprising the all RAPCO slaughterhouse staff participate in this study by answering the prepared questionnaire, the data was collected during august 2015.

Data obtained were analyzed to measure the knowledge, attitudes and practices about food hygiene and safety among food handlers plus other independent variables which are demographic characteristics of the respondents.

4.1.1. Result description

4.1.1.1. Socio demographic characteristics variables

All technical and labor staff of the SH were males (100%) as shown in Figure (4.1).

Fig. (4.1): Respondents gender.
The study showed that (45%) of the respondents were in the age group 20-30 years, (32.5%) were in the age group 31-40 years, (22.5%) were aged between 41-50 years, so about (77.5%) were aged below 40 years as a cumulative percent, as shown in Table (4.1). Strong relationship found between age and knowledge, attitude and practice between age groups \( P = < 0.005 \)

**AGE Table (4-1)**

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-30 Y</td>
<td>18</td>
<td>45.0</td>
<td>45.0</td>
<td>45.0</td>
</tr>
<tr>
<td>31-40 Y</td>
<td>13</td>
<td>32.5</td>
<td>32.5</td>
<td>77.5</td>
</tr>
<tr>
<td>41-50 Y</td>
<td>9</td>
<td>22.5</td>
<td>22.5</td>
<td>100.0</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Concerning the educational level, the result showed that majority of respondents (97.5%) had Secondary and below education level, while (2.5%) had university education level, Figure (4.2).

![Educational Level](image)

**Fig. (4.2): Educational level.**

Regarding the duration of work/years (experience) in the SH the study shows that, (12.5%) of the respondents had less than one year, however (55%) in group 1-5 years, while (32.5%) in group 6+ years, that means more than half of the SH staff has good working experience Figure (4.3).
The study revealed that all food handlers working hours is fixed to one shift of eight hours only per day which is resemble SH working time.

**4.1.1.2. Knowledge variables**

Generally the knowledge of the respondents was very good to the eight questions regarding knowledge which divided into the causatives of food poisoning, personal hygiene, contamination and food conservation, the result was fairly high with mean score 95.6 (possible score 100) for total knowledge mean, most questions answered fairly well, Table (4.2) and Fig.(4.4). We find that questions concerning personal hygiene, contamination and control of food poisoning got high scores (92.5 – 95). The questions concerning identification of contaminated food got lesser score only (80%) while 20% of respondents failed to get the right answer. There result shows significant difference (p= 0.000) between knowledge and education and between knowledge, age and experience, also shows strong correlation between knowledge, attitude and practice (p=0.00).
<table>
<thead>
<tr>
<th>Sr.</th>
<th>Question</th>
<th>%</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Food poisoning is caused by pathogenic microbes</td>
<td>85%</td>
<td>10%</td>
<td>5%</td>
<td></td>
</tr>
</tbody>
</table>
| 2.  | Food handler with unhygienic practice could be the source for food contamination with food poisoning pathogens                                                                                       | 92.5%| 5%| 2.5%
| 3.  | Washing hands with soap and water before work reduce the risk of contamination                                                                                                                       | 95% | 5%| 0|
| 4.  | Contaminated meat with pathogenic microbes didn’t show any changes in color and odor.                                                                                                                | 80% | 7.5%| 12.5%
| 5.  | Keeping food at refrigerator temperature helps to prevent food poisoning.                                                                                                                           | 92.5%| 7.5%| 0|
| 6.  | Insects and rodents could contaminate food.                                                                                                                                                          | 92.5%| 5%| 2.5%
| 7.  | Salmonella can be transmitted by poultry meat.                                                                                                                                                        | 92.5%| 7.5%| 0|
| 8.  | Bacteria does not multiply rapidly on dry cold surfaces.                                                                                                                                             | 90% | 7.5%| 2.5%

Table (4-2): Knowledge Questions & Results
Fig. (4-4): Knowledge Results
4.1.1.3. Attitude variables

All of the respondents reported positive attitudes when handling foods. All of them (100%) stated that, safe food handling was an important part of their job responsibilities. About 92.5% stated that learning more about food hygiene and participate in any training courses was imperative for them. The majority of 97.5% agreed they have to report to the supervisor their health status or if they observe any abnormal observation during their work. Majority of 87.5% showed positive attitude towards food safety regarding the seriousness of health and economic effects. See Fig.(4.5) and Table(4.3). Significant relationship with knowledge found P=0.000.

**Fig. (4-5): Attitude**
Table (4-3): Attitude Questions & Results

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Question</th>
<th>Agree</th>
<th>Uncertain</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Safe food handling is an important part of my job responsibility.</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>Food handler can be a source of food-borne diseases</td>
<td>92.5</td>
<td>5</td>
<td>2.5</td>
</tr>
<tr>
<td>3.</td>
<td>Food safety training is important to me</td>
<td>95</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>I have to report my health problems to my supervisor before work if I have any.</td>
<td>97.5</td>
<td>2.5</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>Food borne illness can have a serious health and economic effects.</td>
<td>87.5</td>
<td>10</td>
<td>2.5</td>
</tr>
<tr>
<td>6.</td>
<td>I have to report any abnormal observations during my shift to the supervisor.</td>
<td>97.5</td>
<td>2.5</td>
<td>0</td>
</tr>
</tbody>
</table>
4.1.1.4. Practice variables

When food handlers did not practice good personnel hygiene or proper handling, they can be the vector for growth of microorganisms through hands, cuts, mouths, skins and hairs (Bryan 1988). Table (4-6) presented the results obtained from the nine related questions. Respondents in this study showed good practices when 92.5% of them wash hands after using the toilet. All respondents 100% wash their hands thoroughly with soap and hot water before handling foods. Many of the previous studies proved that it is crucial to practice self-hygiene especially hand hygiene because hand is the major agent that transmit microorganisms and intestinal parasites to foods (Aarnisalo et al. 2006). Approximately 97.6% of the respondents produced good personnel hygiene practices. According to Bas et al. (2004), the staff employed in food and beverages services should have a clean, tidy and proper appearance, without any skin infections, good dental hygiene, have short finger nails and are not in the habit of biting nails, do not wear jewellery except wedding ring, wearing no make-up, work in clean shoes and uniform, and stick to good hygiene practices. Most of the studied respondents fulfilled these characteristics. All of the respondent wear gloves, apron, mask, head cover and boots. And also all of them trust the products of their company and recommend it to others. Fig. (4.6) & Table (4.4)
Fig. (4-6): Practice
### Table (4-4): Practice Questions & Results

<table>
<thead>
<tr>
<th>Ser.</th>
<th>Question</th>
<th>%</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Do you wash your hands with soap and water before work?</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>Do you wear gloves, mask, and head cover before handling your work?</td>
<td>100</td>
<td>0</td>
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<tr>
<td>3.</td>
<td>Do you wear protective apron and boots?</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>Do you come to work as normal if you have a diarrhoea?</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>5.</td>
<td>Do you eat, drink and smoke while working?</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>6.</td>
<td>Do you wash your hands with soap and water after using the toilet?</td>
<td>92.5</td>
<td>0</td>
</tr>
<tr>
<td>7.</td>
<td>Do you wear any jewellery while working?</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>8.</td>
<td>Do you dry your hands carefully after washing them?</td>
<td>87.5</td>
<td>0</td>
</tr>
<tr>
<td>9.</td>
<td>Do you use the products of your company and recommend it to your friends?</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>
4.1.1.5. Observational checklist variables

Total of 2 visits to the company slaughterhouse was done during different times during the work shift which is 8-hrs. The first visit was for the purpose interviewing the slaughter house management and technical advisor Table (4.5) and also to observe the premises concerning location, the building and connected facilities. The second visit was to observe slaughterhouse real time work Table (4.6) and the result was as follows:

1) The slaughterhouse is located in Dighaga area in Ras Alkhaimah, its location in the far east side of the company land, nearest production unit is about 1 km away, unfortunately it is surrounded by resident area which now approach the north and east sides of the company land, nearest house is about 500 meter away. The other problem facing the company is attributed to absence of any type of walls or fences around the company farm that prevent free movement of animals and civilian activities.

2) The slaughterhouse building is old but in good condition, it is divided in two parts the first one is management section offices, stores, maintenance room, dressing rooms, toilet and washing rooms. All facilities are available clean, sanitized and well maintained. The other part is the slaughterhouse which consist of five isolated divisions which are receiving and hanging area, slaughtering, scalding and plucking area, head removal and leg cutting, evisceration area, packaging area and chilling room.

3) The slaughter house building follow all needs for GHP and GMP concerning building materials, constructions, drainage, ventilation, lighting etc.

4) The birds receiving area is completely isolated from the other part of the facility, all workers observed wear protective clothes, mask,
boots and head cover. There is a machine for cleaning and sanitizing of the empty cages directly after removal of birds which hanged and enter to the second step through the conveyor chain.

5) Through the visit of all production stages hygienic practices and cleanliness observed from all SH staff.

6) All steps of the production are supervised by the technical staff who give notes, advice or solve problems if any.

7) During the visit food handler fitness and good hygienic practice is observed, also health cards and health records of the SH staff are checked were they are all valid and records are up to date.

8) During management interview all related records and documents were checked.
Table (4-5): Management interview

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>Y</th>
<th>N</th>
</tr>
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<tbody>
<tr>
<td>Implementation of HACCP system</td>
<td>✓</td>
<td></td>
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<tr>
<td>ISO CERTIFICATION</td>
<td>✓</td>
<td></td>
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<tr>
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</tr>
<tr>
<td>Pest control program</td>
<td>✓</td>
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<tr>
<td>Adoption of poultry meat product hygiene practice manual</td>
<td>✓</td>
<td></td>
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<td></td>
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<tr>
<td>Developed cleaning and disinfection procedures</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Periodic medical examination for workers</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Characteristics</td>
<td>Y</td>
<td>N</td>
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<td>-------------------------------------------------------------------------------</td>
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<tr>
<td>Proper personal hygiene practices observed</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Staff observed with restraints and clean uniform and with good health</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Staff observed washing hands as needed</td>
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<td></td>
</tr>
<tr>
<td>Use gloves/utensils as needed</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Work surfaces are washed, sanitized &amp; dry</td>
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<tr>
<td>Send poultry products samples to laboratory for bacterial testing</td>
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<tr>
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<td>Areas are properly ventilated, clean and maintained</td>
<td>✓</td>
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</tr>
<tr>
<td>Freezing temperature (-40) degrees Celsius inside freezing section</td>
<td>✓</td>
<td></td>
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</table>
CHAPTER FIVE
DISCUSSIONS

Food handler’s knowledge level in this study can be categorized as fairly high with mean score of 95.6%. This result matches with the findings of Hislop and Shaw (2009), who found that 94% of the certified and non-certified food handlers surveyed scored higher than 70%.

All respondents demonstrate excellent knowledge in nearly all aspects of the knowledge questions, they displayed higher knowledge level for hygiene and contamination factors (93.75%, 92.5%) but relatively lower score is detected in the microbial area (86.8%) the same result is in the Beatty et al. (2009) study on the largest salmonella outbreak in Texas found that it was due to mishandling of food by food handlers due to inadequate knowledge of microbial characteristics which may lead to dangerous practices.

About 20% of the food handlers did not know or uncertain that food can be contaminated by pathogenic bacteria without showing spoilage changes. Previous study found that 60% of food handlers did not know that food poisoning was caused by food looked, smelt, and tasted normal (Elizabeth et al., 2003). It was set that if food handlers did not understand that organ loeptic assessment of food was insufficient to identity food contamination by pathogenic bacteria, they were relying on incorrect physical attributes for food safety control (Elizabeth et al., 2003).

Hand washing scores the higher result 95% this concurred with finding from previous studies (Bas et al.; 2007, Santos et al; 2008, Tokuc et al.; 2009) that there was high level of knowledge on hand washing.
The study showed that there is significant difference of the mean score of knowledge by age groups (P=0.000) this result supported by Lorraine et al. (2013) who carried out a study among 499 trained and 199 untrained food handler in British Columbia – Canada of which the result suggested that age group had significant association (P=0.001). Also the study revealed strong association with knowledge, duration of work(experience) and educational level (P=0.000) similar findings reported by other workers (Lorraine et al. 2013, Siow & Norrakiah 2011; Tareq et al. 2011; Maizun &Naing 2002) who identified factors such as experience, training, education level, income, gender and nationality had influence on knowledge. The study also revealed strong correlation between knowledge and attitude and this concurred with the study on behavioral science and food safety explaining that attitude was statistically associated with food safety knowledge (Laura, R. G. 2008)

The majority of the respondents reported positive attitudes when handling foods. All of them (100%) stated that, safe food handling was an important part of their job responsibilities. Most of them (95%) agreed to participate in any training courses if provided. About 92.5% agreed that food handler can be a source of food borne diseases. And about 87.5% know the consequences of food poisoning to the health and economy. The total of 97.5% show positive attitude towards reporting their health state or any abnormal observation that will affect food safety.

However, in the previous study by Clayton et al. (2002), food handlers might be aware of the food safety attitudes they should have, but they may not practice such positive attitudes. It has been also stated by (Aimmees and Pragk, 2004) that workers claim engaging in safe practices more frequently than they actually implemented those practices. This is not concurred with this study were observation prove that most of the
food handlers in this survey show positive attitude and they also practice it when handling foods. Based on Toh dan Birchenough (2000), there was strong correlation between knowledge and food handling practices. Earlier studies on adults also indicated that food safety knowledge tends to increase with age and practice. Younger respondents need to be given additional food safety education (Albert 1995; Rimal et al., 2001). Hence, training, motivation and initiative should be provided to encourage food handlers practicing appropriate attitudes and procedures when working in food areas (Nurul Huda, 2008).

When food handlers did not practice good personnel hygiene or proper handling, they can be the vector for growth of microorganisms through hands, cuts, mouths, skins and hairs (Bryan, 1988). Respondents in this study showed excellent practices with total mean of 99% this result supported by observational check list which confirmed high level of hygienic and food safety practices between the respondents this may be due to strict commitment of the high management to HACCP and challenges facing the company also may be due to the good training and nationality of the workers, all of them are Asian foreigners this agreed with Mohd. Firdaus Siau et al.(2015) who found in his study two factors significantly influencing food handlers practices were the nationality of food handler (p<0.05) and education level (p<0.05), this is also stated based on Toh and Birchenough (2000), there were strong correlation between knowledge and food handling practices. The findings of the previous studies highlight the importance of incorporating regular training among food handlers in food safety and personal hygiene (Githiri et al. 2009; Muinde and Kuria, 2005). Study reported that improved knowledge will lead to behavioural changes involving better practices in handling of food and also suggested that other factors including staff
attitudes can limit the improvements of staff practices in food safety (Griffith and Clayton, 2005). In another study conducted in school food service, it was established that the food safety knowledge was high but the safe food handling was not practiced during food preparation (Henroid and Sneed, 2004). This prove that there are other factors other than knowledge affecting good practice. 92.5% of the respondents wash hands after using the toilet but only 87.5% dry their hands carefully after washing them. Many of the previous studies proved that it is crucial to practice self-hygiene especially hand hygiene because hand is the major agent that transmit microorganisms and intestinal parasites to foods (Aarnisalo et al. 2006). Approximately 98% of the respondents produced good personnel hygiene practices. According to Bas et al. (2004), the staff employed in food and beverages services should have a clean, tidy and proper appearance, without any skin infections, good dental hygiene, have short finger nails and are not in the habit of biting nails, do not wear jewellery except wedding ring, wearing no make-up, work in clean shoes and uniform, and stick to good hygiene practices. Majority of the studied respondents fulfilled most of these characteristics.
CHAPTER SIX
CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusions

This study revealed that the food handlers working in the RAPCO slaughterhouse show fairly high level of knowledge, attitude and practice the mean score of the study variables was (96%).

The study showed that the strict performance of working procedures in accordance with HACCP system principles and food hygiene is essential for efficient safe food assurance, suitable working environment from the hygienic–technical point of view and motivated, satisfied and qualified personnel are essential criteria to assure that.

The study revealed that the company farms have serious problems concerning biosecurity in need of urgent solution due to rapid growing of the residential area and civilian’s activities within the company land.

6.2. Recommendations

1- The company must continue to raise the awareness of their food handlers towards hygiene and food safety, and must continue more intensive education and training for their employees regarding food safety.

2- The company is in need to leave the residential area to another place which is safer for production and fulfil the needs of biosecurity.

3- As an urgent solution the company is in need to build fences around the company land and to remove all animals shelters found there.

4- The company is in need to build new slaughterhouse within their current company land but far away from the residential area.
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doi:10.1016/j.foodcont.2008.08.013


APPENDICES

University Of Gezira
Faculty of Health & Environmental Sciences
Master Degree Program

Questionnaires to determine the knowledge, attitudes and practices among Ras Al Khaimah Poultry Company Slaughterhouse Workers – Ras Al Khaimah - UAE

**Demographic Characteristics**

**Gender**
- □ Male
- □ Female

**Age**
- □ 20 - 30
- □ 41 - 50
- □ 31 - 40
- □ 51 + .....

**Education**
- □ Primary school
- □ Secondary school
- □ College

**Time spent in this job**
- □ Less than 1 -year
- □ 1 - 5 years
- □ 6 - ... years

**Shift time duration**
- □ 8 hrs.
- □ 9 hrs.
Food Safety - KAP STUDY

KNOWLEDGE

1- Food poisoning is caused by pathogenic microbes
   - □ Agree
   - □ Disagree
   - □ Don’t know

2- Food handler with unhygienic practice could be the source for food contamination with food poisoning pathogens
   - □ Agree
   - □ Disagree
   - □ Don’t know

3- Washing hands with soap and water before work reduce the risk of contamination
   - □ Agree
   - □ Disagree
   - □ Don’t know

4- Contaminated meat with pathogenic microbes did not show any changes in color and odor
   - □ Agree
   - □ Disagree
   - □ Don’t know
5- Keeping food at refrigerator temperature helps to prevent food poisoning
   - ☐ Agree
   - ☐ Disagree
   - ☐ Don't know

6- Insects and rodents can contaminate food
   - ☐ Agree
   - ☐ Disagree
   - ☐ Don't know

7- Salmonella can be transmitted by poultry meat
   - ☐ Agree
   - ☐ Disagree
   - ☐ Don't know

8- Bacteria does not multiply more rapidly in dry cold surfaces
   - ☐ Agree
   - ☐ Disagree
   - ☐ Don't know

**PRACTICE**

9- Do you wash your hands with soap and water before you start working?
   - ☐ Yes
   - ☐ No
   - ☐ Sometimes
10- Do you wear gloves, mask and head cover before handling your work?
   • [ ] Yes
   • [ ] No
   • [ ] Occasional

11- Do you wear protective apron and boots?
   • [ ] Yes
   • [ ] No
   • [ ] Occasional

12- Do you come to work as normal if you have a diarrhea?
   • [ ] Yes
   • [ ] No
   • [ ] Sometimes

13- Do you eat, drink and smoke while working?
   • [ ] Yes
   • [ ] No
   • [ ] Sometimes

14- Do you wash your hands with soap and water after using the toilet?
   • [ ] Yes
   • [ ] No
   • [ ] Sometimes
15- Do you wear any jewelry while working?
   - ☐ Yes
   - ☐ No
   - ☐ Sometimes

16- Do you dry your hands carefully after washing them?
   - ☐ Yes
   - ☐ No
   - ☐ Sometimes

17- Do you use the products of your company and recommend it to your friends?
   - ☐ Yes
   - ☐ No

**ATTITUDE**

18- Safe food handling is an important part of my job responsibility
   - ☐ Agree
   - ☐ Disagree
   - ☐ Don’t know

19- Food handler can be a source of food- borne diseases
   - ☐ Agree
   - ☐ Disagree
   - ☐ Don’t know
20- Food safety training is important to me

- □ Agree
- □ Disagree
- □ Don't know

21- I have to report my health problems to my supervisor before work if I have any

- □ Agree
- □ Disagree
- □ Don't know

22- Food borne illness can have serious health and economic effects

- □ Agree
- □ Disagree
- □ Don't know

23- I have to report any abnormal observation during my shift to the supervisor

- □ Agree
- □ Disagree
- □ Don’t know
**Interviewing of top management personnel at RAPCO**

<table>
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## Practices implemented in RAPCO slaughterhouse (Observation)

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<th>Y</th>
<th>N</th>
<th>SOMETIMES</th>
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<tr>
<td>Proper personal hygiene practices observed</td>
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<tr>
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