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Public and Environmental Health

Faculty of Health and Environmental Sciences

November , 2015

Hanan Hassan MekkiAbdulah

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November , 2015

Hanan Hassan Mekki

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<td>Internal Examiner</td>
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Date of Examination 14 November , 2015
DECLARATION

I hereby declare that this thesis is my own work and effort and that is has not been submitted anywhere for any award. Where other sources have been used, they have been acknowledged. This work was done under supervision of Dr. Elrashed Elgaili Mohamed Ali and Dr. Ibrahim Elhag Elmahdy at Faculty of Health and Environmental Sciences, University of Gezira.

Signature:

Date:
Dedication

To my father who had been a father, teacher, brother and a friend.

To the warm heart, the angle that took care of me and without her caring, motivation and support, it would not been possible to conduct this work. I wish her all the best.

To the brothers Osama, Sami & Lai who gave me valuable support and warm encouragement for my career development and emotional support.

To the man who gave me his name self & life, my husband Abdul Salam Alamin who encouraged me to fulfill the hard studding time during exams, he really designed my life and make my dreams true.

To the part of my heart and soul, to my sun Hussam, whom I have tasted with, what it means to be a mother.

To my close friends who made my life and supported me with warm encouragement for my career development Mustaffa Alsunni, Magdi Youssef, Hafiz Khogali, Salma, Amna & Noor.
AKNOULEDGMEN'T

Special great thanks to my main supervisor, Dr. ElrashedElgaili Mohamed Ali for his big contribution and hard work during this research it is very great indeed. My work during the research would be nothing without his keenness and supports.

My grateful thanks also to Dr. Ibrahim El hagElmahdy the Public & Environmental Health dean for supervision and support that gave truly help progression and smoothness of the research.

Great appreciation goes to the rest of the master course teachers.

Great deals appreciated go to Al Gezira University for this opportunity. I also would like to thank the Coordinators of this master course - Mr. Al Daw Omer and Mr. Ahmad abdElgafour.

Last but not least, I would like to thank my colleagues who shared me those moments. And my friends who supported me to study successfully.
Hanan Hassan Mekki Abdullah

ABSTRACT

People have the right to expect all their food and drink to be safe and suitable for consumption. Food borne illness and food borne injury are at best unpleasant; at worst, they caused by the consumption of contaminated food and drinks. The purpose of this study is to evaluate the good hygiene practices (GHP) in “Best Food Factory” in Omdurman city, Sudan. The study carried on the basis of knowledge, attitude and practice. The sample for this study was the whole population of “Best Food Factory”.

In this study, seven good hygiene practice (GHP) variables were examined food, including, hand washing, operational hygiene, personal hygiene, food storage, cleaning and disinfection waste management and pest control, the data collected by completing the questionnaire based on the good hygiene practice (GHP) variables by the food handlers.

The results were analyzed by using Statistical Package of Social Science (SPSS).

The result discloses lack of knowledge, attitude and practice among the food handlers due to the absence of training factor and unavailability of the good hygiene practice (GHP) requirements and the main reason for that is no clear food safety regulations and law, no routine inspections by the local authority and lack of management awareness and commitment. The study recommends providing the top management with trainings on food safety management, providing the food handlers with further specific training courses according to their role and their level of education, the factory should be strictly monitored by the local authority, implementation of quality management system (9001/2008), implementation of a food safety system such as HACCP.
تقييم الممارسات الصحية الجيدة في مصنع بست للأغذية في محلية أم درمان، ولاية الخرطوم، السودان (2015م)

حنان حسن مكي

ملخص الدراسة

من حق الإنسان أن يتوقع أن يكون مأكله ومشربه آمناً ومناسبًا للاستهلاك. والأمراض المنقلة من خلال الغذاء تسبب إصابات غير سارة ناجمة عن استهلاك المواد الغذائية والمشروبات الملوثة. الغرض من هذه الدراسة تقييم الممارسات الصحية الجيدة بمصنع "Best Food Factory" بمدينة أمدرمان، السودان. تم إعدادها عام 2015 على أساس دراسة المعرفة، السلوك والممارسة.

العينة لهذه الدراسة تشمل جميع العاملين بمصنع "Best Food Factory" تم في هذه الدراسة اختبار سبع متغيرات للممارسات الصحية الجيدة تشمل غسيل اليدين، صحة العمليات التشغيلية، الصحة الشخصية، نحزين المواد الغذائية، التنظيف والتعقيم، إدارة المخلفات وكافحة الحشرات. تم جمع البيانات عن طريق استكمال الاستبيان المبني على متغيرات الممارسات الصحية الجيدة بواسطة متداولي الاغذية. تم تحليل النتائج باستخدام البرنامج الحاسوبي الإحصائي (SPSS). كشفت النتائج أن هناك نقص في المعرفة، السلوك والمشاركة بسبب غياب عامل التدريب لدى متداولي الأغذية وذلك بعده لعدم وجود قوانين وتشريعات، عدم وجود رقابة روتينية من قبل السلطات المحلية وعدم وجود الوعي والإلتزام الإداري.

توصيات الدراسة بضرورة تدريب الإدارة العليا على الممارسات الصحية السليمة، ضرورة التركيز على تدريب العاملين في مجال الإنتاج على الممارسات الصحية السليمة، كما ينبغي توازن من مستوى الفهم، حيث السلطات الحكومية على ضرورة متاحة لمن نواحي التدقيق الغذائي والمارسات الصحية، تطبيق برامج الممارسات الصحية السليمة، تطبيق أنظمته الهامة.
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ABBREVIATIONS

KAP: Knowledge, Attitude and Practice
GHP’s: Good Hygiene Practices
HACCP: Hazard Analysis Critical Control Point
CDC: Center of Disease Control and Prevention
GAP: Good Agricultural Practice
GMP: Good Manufacturing Practice
QHEO: Quality and Health Education Office
SFSP: Sharjah Food Safety Program
GCC: Gulf Countries Council
SPSS: Statistical Package of Social Science
WHO: World Health Organization
4Cs: Clean, Combat Cross Contamination, Cook, Chill
ACC: Aerobic Colony Count
UK: United Kingdom
US: United States
NASI: National Standards Authority of Ireland
IS: Irish Standards
CHAPTER ONE
INTRODUCTION

1.1 Preface:

People have the right to expect all their food and drink to be safe and suitable for consumption. Food borne illness and food borne injury are at best unpleasant; at worst, they caused by the consumption of contaminated food and drinks. The cause of food poisoning can be fatal. Outbreaks of food borne illness can damage trade and tourism, and lead to loss of earnings, unemployment and litigation. Food spoilage is wasteful, costly and can adversely affect the consumer confidence. International food trade, and foreign travel, is increasing, bringing important social and economic benefits. This also makes the spread of illness around the world easier. Eating habits too, have undergone major change in many countries over the last two decades and new food production, preparation and distribution techniques have developed to reflect this. Effective hygiene control, therefore, is vital to avoid the adverse human health and economic consequences of food borne illness, food borne injury, and food spoilage (FAO, 1999).

Incidents of food borne disease, especially those widely publicized in the media, highlight the problems that need to be overcome to achieve safe preparation, handling, storage and distribution of food. They also act as a constant reminder that food borne disease occurs even where formal national or local government controls are in force. Routine inspections of food service establishments may help to ensure that food is prepared in a clean environment, but often cannot control other factors that contribute to food borne disease. Carrying out daily inspections is neither practical nor effective. The recent emergence, in some developed countries, of food borne illness associated with foods not previously implicated, e.g., salmonellae in eggs and Listeria in chilled foods, indicates that contamination of raw products can be a problem. However, on a worldwide basis, most such illness is caused by foods that have been mishandled or mistreated during preparation. One of the most effective preventive measures to deal with food borne illness is thus to educate food-handling personnel in safe practices. (Safe food handling, world health organization, Geneva, 1989).
1.2 Problem Identification and Justification

1.2.1 Identification

Food hygiene is an increasingly important public health issue all over the world. All governments are intensifying their efforts and budgets to improve food safety issues. Although, there were much numbers of food safety problems that resulted in death, so we have to carry efforts on raising the knowledge and practice during the different food processes and taken much care about the consumer concerns. Now, the very important updated standard concerning the food safety issues is HACCP systems, and one of the important HACCP tools is Good Hygienic Practices (GHPs) that concentrates on the hygienic practice involving all the management commitments’ and food handler roll. In Sudan we were having many difficulties in implementing a proper HACCP system, but we can at least think about the GHPs to control the high risk food and drink industry.

Most of the studies conform the main causes of food-borne illness are, sick food workers, poor personal hygiene, improper holding temperature, improper cooling, inadequate cooking and reheating, cross contamination and material the use of raw material from non reputable suppliers. All the mentioned causes will be covered and controlled by following proper GHPs.

In the Best Food Factory, they were dealing with milk, yoghurt and juices that was a high risk food products as also been a ready to eat without any additional heat treatments and because most of the end user from the risk groups (the children and old people). My study was conducted to evaluate the GHP practices that had a great Influence in the end consumer products and health care.

1.2.2 JUSTIFICATION

- There are no previous referenced studies on GHP parameters in food factories in Sudan.
- To evaluate the good hygiene Practice in Best Food Factory.
- To consider and apply good hygiene practice elements as compulsory requirements in food factories.
To enrich the literature with guiding elements to be considered when practicing and/or auditing GHPs within any food establishments.

1.4 OBJECTIVES:

1.4.1. General Objective:

1.4.2. Specific Objectives:

- Assessment of current situation of Best Food Factory.
- Knowledge, attitude and practices of workers toward (GHP)
- To improve good hygiene practice implementation.
CHAPTER TWO
LITERATURE REVIEW

2.1 DEFINITIONS

**Cleaning** – is the removal of soil, food residue, dirt and grease (Sprenger, 2009, basic food hygiene).

**Contaminant** - Any biological or chemical agent, foreign matter, and other substances not intentionally added to food which may compromise food safety or suitability (Sprenger. HACCP for food handlers, 2007)

**Contamination** – is the introduction or occurrence of a contaminant in food or food environment (Codex, 2004).

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

**HACCP (hazard analysis and critical control point)** - A system which identifies, evaluates, and controls hazards which are significant for food safety (Sprenger, 2009, food safety for management).

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

**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).

**Food borne illness**- Defined as diseases, usually either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food. Every person is at risk of food borne illness (Taylor, 2011).

**Food hygiene**- All conditions and measures are necessary to ensure the safety and suitability of food at all stages of the food chain (FAO and WHO, 2003).

**Good Hygienic Practices (GHPs)** - 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).
**Knowledge:** According to the Merriam-Webster Dictionary, knowledge is defined as the fact or condition of knowing something with familiarity gained through experience or association. In Plato's Theater us, Socrates and Theater us discuss three definitions of knowledge: knowledge as nothing but perception, knowledge as true judgment, and, finally, knowledge as a true judgment with an account. Each of these definitions has been shown to be unsatisfactory (Audi, 2011).

**Attitude:** Eagly and Chaiken (2007) defined an attitude as a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour. Attitude is translated from response towards a particular object and may be accompanied by a tendency to act in accordance with the perception to the object. In this context objects are not only physical objects or individuals, but can also be events, norms, values and so forth (Pratkanis et al, 1989).

**Practice:** Azemi (2010) argued that an attitude may not automatically translate to an action/practice. A supporting factor or proper conditions are needed for an attitude to become a real action. Practices also consist of several levels which are:

### 2.2 Food Hygiene

All consumers have the right to expect and demand safe, good quality food. Successful domestics and international trade in food and a sustainable agriculture-based development depend on safe food supplies that meet buyer’s quality requirements.

Food businesses meet their food safety and quality responsibilities by implementing quality assurance system along the food production chain. These set of controls may include Good Agricultural Practice (GAPs), Good Manufacturing Practices (GMPs), Good Hygienic Practices (GHPs), Hazard Analysis and Critical Control Points (HACCP) system.

Many businesses can face challenges, but in particular small scale producers and traders in developing countries need support in planning and implementing food safety management programs in line with international requirements.

The food safety group promotes the application of preventive food safety management systems by food businesses operators along the food chain in line with
Codex guidelines and recommendations. (FAO for World without hunger, Good Hygiene Practices and HACCP)

Food hygiene involves all the measures necessary to ensure the safety and wholesomeness of food during all the operational processes and distribution till reaching the consumer (WHO, 2004). This will involve:

- Rejecting contaminated food or food from unreliable sources
- Decontaminating food, for example, by washing
- Protecting food from risk of contamination of any kind that includes the effective cleaning and disinfection of food premises and equipment, and requires high standards of personal hygiene and training of food handlers
- Preventing any organisms multiplying to an extent that would expose consumers to risk, or result in premature decomposition of food
- Destroying any harmful bacteria in the food by thorough cooking or processing; and
- Discarding unfit or contaminated food

2.2 Good Hygienic Practices

The GHP system is all the practices regarding the conditions and measures necessary to insure the safety and suitability of food at all stages of the food chain (codex, 2004).

GHP includes:

- Cleaning and Disinfections
- Hand washing
- Personal Hygiene
- Waste Management
- Storage
- Pest control
- Operational Hygiene (temperature control, cross contamination, labeling)

2.3 Food borne Illness:
Infection or intoxication caused by the transfer of microbial or chemical contaminants (substance that spoil or infect) from food or drinking water to a human. In most cases, the contaminants are bacteria, parasites, or viruses.

Food safety precautions: To prevent food borne illness, follow the 4Cs:

- Clean
- Combat cross contamination
- Cook
- Chill


The following statistics are estimates based on reported cases of food borne illnesses in the United State:

<table>
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<th>Number of:</th>
<th>People per year</th>
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<td>Diseases caused by food and resulting on hospitalization</td>
<td>128,000</td>
</tr>
<tr>
<td>Gastrointestinal illness</td>
<td>48,000,000</td>
</tr>
<tr>
<td>Deaths</td>
<td>3,000</td>
</tr>
</tbody>
</table>

Source: Center of Disease Control and Prevention (CDC).

(Science and our food supply, NSTA (2014), Food Safety A to Z Reference Guide.

2.4 Prevention of Food borne Illnesses:

- Ensure the safety of all water supplies. Water used for food preparation or drinking should be chlorinated
- Ensure the satisfactory disposal of sewage
- Ensure the heat treatment of milk and milk products, in clouding ice cream
- Prevent the sale of raw shellfish from sewage polluted water
- Identify carriers and ensure that they are not employed within the food industry, medical questionnaire should be used as an aid to recruitment
- Maintain high standards of personal hygiene amongst food handlers, especially with regard to through hand washing after visiting the toilet
- Ensure high standards of hygiene in food production and distribution
- Double-wash ready to eat fruits and vegetables

(Highfield.co.uk limited, Improving Food Safety, 2007, Hygiene for Management, page 52)

**2.5 Food Safety Situation in Sudan:**

The public health burden of food borne disease in the Sudan is considerable. A number of inhabitants become ill, and some die from food borne disease. Many different pathogens and toxins have been identified as causes of food borne disease and new ones continue to emerge.

Prevention also includes food borne diseases caused by infectious agents, natural and environmental toxins. Many food borne diseases that were formerly threatening public health are now controlled by standardized well accepted prevention strategies, such as the pasteurization of raw milk and the appropriate management of food canning.

The increasing food safety problems witnessed by Sudan, requires rapid and effective responses. In order to meet this complex public health responsibility, the national capacity to predict and prevent food borne hazards must be strengthened through public awareness, monitoring and rapidly reacting against outbreaks of food borne diseases and the occurrence of newly emerging food borne agents (CODEX 5, 2013).

**2.6 Sharjah Food Safety Program**

The Sharjah food safety program (SFSP) that organized by Sharjah Municipality City – Food Control Section along with the Quality and Health Education Office (QHEO) of Sharjah Municipality, they implemented a GHPs program for all the food related factories, restaurants, cafeterias, suppliers and retails. They were carrying training for managements and staff who are unable to read and write, followed by examinations and follow up implementation on the floor that will be supervised by their team and certified officially from Sharjah Municipality. The program has recently completed its pilot stage, is showing clear evidence of success. The SFSP is gaining attention from other municipalities in the UAE, and others in the GCC region and the Arab world.

This program gives a clear evidence and conformation about the importance of GHPs in controlling the food safety among all food business. (The Key Elements Behind the
Success of Good Hygiene Practices (GHPs) Program Implemented in Sharjah, UAE
Abdel aziz (2011).
CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Area: Best Food Factory – Omdurman - Sudan

3.2 Population:

The population size is 120 employees

3.3 Study Design:

The study conducted by using knowledge, attitude and practice study (KAP)

3.4 SAMPLING METHOD:

Selected sample

3.4.1 SAMPLE SIZE:

The sample that had been withdrew equals to 30% from the food handler’s population size (37 food handlers).
3.5 DATA COLLECTION:

The data used for the study was collected by using questionnaire.

The questions involve the following areas:

1. Personal Hygiene
2. Cleaning & Sanitation
3. Operational Hygiene
4. Hand washing
5. Waste Management
6. Pest Control
7. Storage
8. Staff occupational Health Certificates
9. GHPs Staff Awareness and Training
10. General

3.6. DATA PROCESSING AND ANALYSIS

Data were processed and analyzed by Statistical Package for Social Science (SPSS).

3.7. MORAL CONSIDERATIONS:

An official consent was taken from the top management of the Best Food Factory – Omdurman – Sudan in 2014.
CHAPTER FOUR

RESULTS

All over the world people are seriously affected every day by diseases that are caused by consuming unhygienic and unsafe food. We have to give due emphasis to good practices to prevent and control food borne diseases. Food borne diseases result from eating food that contains infectious or toxic substance. The food we eat should be free from contaminants such as microorganisms and chemicals. Most food-borne illnesses are caused by improper handling of food. The studies show that some of the most common causes of food borne illness are, Sick food worker, poor personal hygiene, improper holding temperatures, improper cooling, inadequate cooking and reheating, cross contamination and use of food from unknown source. The most important food safety program all over is HACCP, before thinking about implementing the HACCP, basic good hygiene conditions and practices called prerequisites must be in place. HACCP can then be used to control steps in the business which are critical in ensuring the preparation of safe food. The National Standards Authority of Ireland (NSAI) has produced sector specific Irish Standards (I.S.) to good hygienic practice. All food businesses are advised to use the appropriate standard for their sector. Good hygienic practices are about the conditions and measures necessary to ensure the safety and suitability of food at all stages of the food chain.

In Sudan there are plenty of difficulties in introducing and implementing proper principals of food hygiene and safety. Such control systems would be a team work and efforts that starts seriously from the owners and management commitment followed by supervisors and workers (CODEX 5, (2013).

Total of (37) food handlers in Best Food Factory were interviewed in December, 2014 by the candidate accompanied by hygiene supervisor to evaluate knowledge, attitude and practice regarding the GHPs. In addition to good hygiene practice check list.

The questionnaire and the check list were designed according to the international requirements of good hygiene practice which are covering the environmental Health, hygienic production of food sources. Handling, storage and transportation of raw materials in addition to cleaning, maintenance and personnel
hygiene at primary production is also covered by the check list. The location of food establishments and design and facilities plus premises layout and rooms of food establishments were also examined. Temporal premises, vending machine and facilities (water supply, drainage and waste disposal and cleaning, etc) were also included. Control of food hazard and employee health status, personal hygiene and training on food safety measures was evaluated.

The location of Best Food Factory, vending premises means of transportation and proper storage are essential for food safety produced in this factory. In this study, the location of best food factory is not fulfilling the standard requirements for food manufacturing hygiene measures. The factory located in unhygienic environment near to pollutant source such as chemical industries, mechanic workshops can affect food safety. The premises have rough cement floor with no slope to the drainage system. The transportation vehicles are belong to the factory not well equipped (design, temperature control) which affects food safety. The factory has no suitable stores for storing the final product (bad flooring).

Training of the food handlers is intended to modify or develop knowledge, skills and professional attitude through learning experience to achieve effective performance in an activity or range of activities. Although ignorance may be a factor, most food poisoning incidents are caused by failure of managers and food handlers to implement good hygiene practice. The entire factory food handlers did not attended any training on food safety. 100% of the factory food handlers they don’t have awareness on GHPs and its implementation benefits and 100% of them they don’t not know why to wash hands but there is no hands wash facilities in the production area. However most of the food handlers have awareness on good hygiene practice but does not reflect on their practice.

Hygiene facilities for factory food handlers (hand washing basins and toilets) and predetermined cleaning programs, monitoring cleaning records with a report notice for high / low risk areas and keeping schedule in place is necessary for food safety in the food factory is not provide with proper hygiene facilities (toilets and hand washing basins).

Data displayed on Table (4.1) shows that 100% of the factory food handlers are not aware of cross contamination but there is no separation of equipments and tools
even that used to clean the floor and toilets (Table 4.2). Whereas 90% of them they
don’t know correct temperature of milk storage (Table 4.1).

The results also showed that 100% of the food handlers know the production andexpiry date of milk due to the daily practice (Table 4.3). In the other hand 100% ofthem do not know what are the reasons for labeling (Table 4.2). Pasteurization is animportant step in fresh milk processing that used to decrease the number of bacteria inthe milk in the same time it is affecting nutritive value of the milk, however allrespondents answer the question of pasteurization important for killing bacteria.

Waste is one of the source of bacteria in any food establishment is the waste, so itis very important to store and dispose the waste as per the good hygiene practices.100% of the food handlers in best food factory agree that by proper disposalprocedures of waste we can avoid growth and multiplication of bacterial (Table 4.2).

Pest control is essential for food safety in any food establishment. About 100%of food handlers did agree that pests play role in food contamination (Table 4.2). 95%of the food handlers agreed that stock rotation is very important for food safety (Table4.2).

Food handlers are a serious hazard in any food establishment they can addphysical, chemical and biological hazards. The control measure of the hazards addedby the worker is the provision of protective clothing. 100% workers did agree thatprotective clothing reduce of contamination, barley the food handlers were notwearing any kind of protective clothing during the processing (Table 4.2). 95% offood handlers answered the question of “food handlers with a abrasion or cut fingershould not touch ready to eat products” with agree (Table 4.3).

Changing room is the important facility that support personal hygiene of thefood handlers 100% of the food handlers did change their normal dress in the factorydue to the unavailability of changing room premises (Table 4.3).

As a part of hygiene practices smoking or using snuff can cause biological andphysical ccontamination.100% of the food handlers did not smoke or use snuff in theproduction area (Table 4.3).
### Table 4.1: Knowledge of workers of Best Food Factory

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<th>Sr .</th>
<th>Question</th>
<th>%</th>
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<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>1.</td>
<td>Do you know GHP stand for what</td>
<td>60%</td>
</tr>
<tr>
<td>2.</td>
<td>Do you know the component of GHP</td>
<td>40%</td>
</tr>
<tr>
<td>3.</td>
<td>Lake of GHP will guide to</td>
<td>50%</td>
</tr>
<tr>
<td>4.</td>
<td>Do you know why to wash your hands</td>
<td>100%</td>
</tr>
<tr>
<td>5.</td>
<td>Do you know how milk contaminated</td>
<td>100%</td>
</tr>
<tr>
<td>6.</td>
<td>Do you know what is pasteurization</td>
<td>100%</td>
</tr>
<tr>
<td>7.</td>
<td>Do you know what is cross-contamination</td>
<td>100%</td>
</tr>
<tr>
<td>8.</td>
<td>Do you know what is the risk associated with raw milk</td>
<td>100%</td>
</tr>
<tr>
<td>9.</td>
<td>Do you know the correct temperature for milk storage</td>
<td>100%</td>
</tr>
<tr>
<td>10.</td>
<td>Do you know shelf life of milk &amp; milk products</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 4.2: Attitude of workers of Best Food Factory

<table>
<thead>
<tr>
<th>Sr .</th>
<th>Question</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Separating raw milk is an important part avoid cross contamination</td>
<td>94%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6%</td>
</tr>
<tr>
<td>2.</td>
<td>Applying pasteurization process is very important for killing bacteria</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>3.</td>
<td>Storing pasteurized milk on correct storage temperature is very important process</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>4.</td>
<td>By applying proper waste disposal procedure we can avoid bacterial growth &amp; breeding</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>5.</td>
<td>Pest play strong role on food contamination</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>6.</td>
<td>Training and learning about food safety is important to me</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>7.</td>
<td>Using hairnet, masks , protective gloves and adequate clothing reduce the risk of contamination</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>8.</td>
<td>Applying stock rotation is very important for food safety</td>
<td>94%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6%</td>
</tr>
<tr>
<td>9.</td>
<td>Improper storage of milk &amp; milk products may be hazardous to health</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>10.</td>
<td>Food handler with abrasion or cuts finger or hand should not touch ready to eat products</td>
<td>95%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5%</td>
</tr>
</tbody>
</table>
Table 4.3: Practice of workers of Best Food Factory

<table>
<thead>
<tr>
<th>Sr.</th>
<th>Question</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>All time</td>
</tr>
<tr>
<td>1.</td>
<td>Where do you change your dress?</td>
<td>100%</td>
</tr>
<tr>
<td>2.</td>
<td>What do you do when wash your hands?</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Name the occasion when you wash your hands?</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Did you smoke, use snuff?</td>
<td>5%</td>
</tr>
<tr>
<td>5.</td>
<td>Do you wash the garbage container after each disposal</td>
<td>95%</td>
</tr>
<tr>
<td>6.</td>
<td>If you get injury in your hand do you cover it?</td>
<td>100%</td>
</tr>
<tr>
<td>7.</td>
<td>Do you know why to make labeling process?</td>
<td>95%</td>
</tr>
</tbody>
</table>
Figure (4.1): Knowledge of workers of Best Food Factory
Figure (4.2): Attitude of workers of Best Food Factory
Figure (4.3): Practice of workers of Best Food Factory
CHAPTER 5

DISCUSSIONS

On this study knowledge, attitude and practices were evaluated using questionnaire and check list designed according to the international requirements of hygiene. Location, Handling, storage and transportation of raw materials in addition to cleaning, maintenance and personnel hygiene are also covered by the questionnaire and check list. The location of factory and design and facilities plus premises and rooms were also examined. Vending machine and facilities (water supply, drainage and waste disposal and cleaning, etc) are also included. Control of food hazard and employee health status, personal hygiene and training on food safety measures is evaluated.

The important factor in controlling the contamination from the surrounding environment such as chemical industries, harborage area that can attract or harbor insects and rodents, waste disposal area and flooded area is the selection of the location that can ensure the contamination from surroundings (Sprenger, 2007).

Best Food Factory located in such locations did not ensuring food safety and this is recommended by local and international standards. Similar study conducted in Saudi Arabia on the year 1425 H (2004) to evaluate the status of the hygienic and sanitation aspects of pilgrims catering establishments such as location; its surrounding environment; the external and internal condition of the building; the extent of applying hygienic measures during food preparation, service, transportation and preservation according to its nature; and waste disposal. The hygienic practices of the workers in these premises were also evaluated.

The study revealed that the surrounding environment is not suitable for the activities of the majority (98%) of the food catering establishments, as the surrounding environment considered a good haven for pests, a source of offensive smell or contained stalled water (SFDA, 2012).

A study conducted by the Centers for Disease Control (CDC) on March, 2012. The CDC study, published online in Emerging Infectious Diseases, reviewed dairy-related outbreaks between 1993 and 2006 in all 50 states, during which time the
authors counted 121 dairy-related illness outbreaks resulting in 4,413 illnesses, 239 hospitalizations and three deaths.

Despite raw milk products accounting for approximately one percent of dairy production in the U.S., raw milk dairies were linked to 60 percent of those dairy-related outbreaks. In addition, 202 of the 239 hospitalizations (85 percent) resulted from raw milk outbreaks. Thirteen percent of patients from raw milk outbreaks were hospitalized, versus one percent of patients from pasteurized milk outbreaks.

The study found that individuals under the age of 20 accounted for 60 percent of those affected by raw milk outbreaks, compared with 23 percent associated with pasteurized products. Children were also more likely than adults to become seriously ill from pathogenic bacteria in raw milk.

Transportation of milk (raw and final products) plays a major role in food poisoning outbreaks, ready to eat foods are a high risk foods support the rapid multiplication of pathogenic bacteria that need strict transportation conditions of temperature and segregation from raw foods or chemicals.

The study exposed that best food factory has delivery service, but did not equipped properly (on thermometer witnessed).

The importance of cleaning lies on removing the food remains that are nutrients for the pathogenic bacteria as well as facilitating the disinfection. Maintenance of the equipment also makes the cleaning easier. It is a difficult task to clean cracked surface or floor that may hide bacteria or insects which is one of the pathogenic bacteria sources.

They found that one square centimeter if it is dirty contains million bacterial cells and if it is clean contains ten thousand bacterial cells and if it is disinfected contains ten bacterial cells (Sprenger, 2007).

The factory is not provided with hygiene facilities, segregated area for cleaning, and predetermined cleaning schedule, cleaning records and maintenance schedule in place.

A study was carried out to determine the microbiological status of surfaces used in the preparation of ready-to-eat foods, and to assess cleaning standards and
practices in food premises in the UK. A total of 6,533 environmental samples were examined from 1,502 catering (such as restaurants, cafés, and sandwich bars) or retail premises (such as butchers, delicatessens, and bakers): 2,033 samples from chopping/cutting boards, 2,009 from worktop surfaces, 1,359 from food containers, and 1,132 from cleaning cloths. Cleaning cloths were more heavily contaminated with bacteria (Aerobic Colony Count [ACC], Enterobacteriaceae, E. coli, and Staphylococcus aureus) compared to surfaces sampled. Campylobacter spp. were detected in two (0.2%) and Salmonella spp. from one (0.1%) of the cleaning cloths. Surfaces that were visually dirty, wet, last cleaned over 24 hours ago, and boards that were scored or damaged were found to have higher levels of bacteria. A hazard analysis system was in place in most (70%) food premises visited, and in 52% it was documented. Most managers (89%) had received some form of food hygiene training. Documented cleaning schedules and cleaning records were only present in approximately half (55% and 44%, respectively) of the premises. Most did not have separate implements for cleaning raw and ready-to-eat food areas (67%), or stored cleaning equipment for high risk (ready-to-eat food) areas away from those used in low risk (raw, non ready-to-eat food) areas (70%). Deficiencies in the correct use of cleaning products, such as the minimum contact time for disinfectants, were identified. Surface samples (chopping/cutting boards, worktops, and food containers) and cleaning cloths with ACC levels in excess of 10(3) cfu/cm2, swab or ml were associated with premises that did not have management food hygiene training, hazard analysis, cleaning schedules or cleaning records in place, and with little or no confidence in the food business management of food hygiene as indicated by Local Authority Inspectors’ Confidence in Management scores. (US national library of medicine, national institute of health)

The surfaces of walls, ceilings, partitions and floors should be made of impervious materials with no toxic effect or release any toxic substance that can cause chemical contamination and should be smooth easy to clean and light color to be recognized if dirty.

The floor should allow cleaning and slope with drainage halls to facilitate cleaning. (Sprenger, 2007)
The materials that used in designing the food equipments and containers can contaminate the food if it is containing heavy metals such as lead, cupper, arsenic, mercury, aluminum and cadmium which are carcinogenic agents (Springer, 2007 food safety for management).

A research study was conducted on 24th December by S. Dabonne, B.P.K. Koffi, E.J.P. Kouadio, A.G. Koffi, E.A. Due and L.P. Kouame Laboratory of Biochemistry and Food Science and Technology, University of Abobo-Adjamé 02 BP 802 Abidjan 02 (Côte D’Ivoire), to show some traditional utensils as potentials sources of poisoning by heavy metals. Milled rice was cooked in a traditional aluminum pot to assess the level of contamination of food by the utensil when cooking. Results showed that aluminum content of cooked rice increased from 1.6 to 18.1 mg/g, more than 11 times (ATT = 11.31). It was also demonstrated that protective layer of inert material present in modern utensils was a good way to protect food from contamination while cooking. Analysis of the mineral composition of other traditional utensil made of clay showed a high content of aluminum (87.5 mg/g) showing that it is also a potential source of food contamination by aluminum.

The processing equipments in best food factory designed from materials that does not react with the food or release any heavy metals while processing and made of stainless steel and for water supply.

The light density necessary for monitoring the food hazards especially physical and spoiled foods at the receiving points. The lights should be covered to avoid the physical contamination in case of the lights breakage there for any food establishment should have breakage policy in place covering the lights.

Best food factory lights have no cover in the processing area and storage area with no enough density.

Foods can be damaged and also contaminated by pests. Many stored grains are lost through the damage done by pests, including termites (*mist*), beetles, locusts, cockroaches, flies and rodents such as rats and mice. Pests can damage and contaminate foods in various ways, such as boring into and feeding on the insides of grains, or tunneling into stems and roots of food plants. For example, weevils cause large losses of stored grains, especially in warm and humid conditions such as in lowland areas of Ethiopia.
Pests also damage the protective skin of foods allowing microorganisms to get inside the food and causing it to rot more quickly. Pests can pollute food with their excreta and with bodies and body fragments when they die. They also transfer microorganisms on to food while walking on it. Flies and cockroaches readily move between wastes and foods, transporting microorganisms with them as they go.

Pests is controlled in the food establishments through maintenance of the buildings, cleaning and removing of the dirt, proper waste management, using of approved pest Control Company by the concerned department and training of the staff on pest checks (Jerry Taylor, PIC level 3, 2011). Best food factory management did not prove that there is pest control procedure in place by presenting pests control evidence.

A food handler is a major hazard in the food establishment as he can contaminate the food with so many hazards especially if he is ill, he can transfer pathogenic bacteria into the food and cause food poisoning to the consumer.

The chances of food contamination largely depend on the health status of food handlers & their hygiene behaviors and practices. Often these food handlers are being appointed without proper health examination. Hence community based cross-sectional study was conducted on randomly selected 160 food handlers of both sex to assess health status of food handlers working in food establishment nearby a medical institute. Stool examination and nail culture was also done.

There was no registration of these food establishments. Most of the food handlers were young in age, mostly cooks (35.62 %) and literate (63.13 %). Point prevalence of morbidity was 54 (33.75%) and period prevalence 26.25 %. 21.87 % were anemic. Microbial positivity rate for their stool & nail culture was 97 percent.

Registration of all food establishments should be mandatory. Pre-placement and periodical medical checkup is the key to improve health status of food handlers for better food safety. Best Food Factory has no fitness policy to enable hazards from infected food handlers.

High standard of personal hygiene are essential to reduce the risk of food borne illness and a pre-requisite of GHP’s. The risk associated with food handlers contaminating high risk food with low dose organisms such as E.coli O157, noro
virus, hepatitis C, Salmonella Typhi, Shigella spp. And Campylobacter should not be underestimated. Personal hygiene of staff is a management responsibility and must be dealt with proactively. It must not be assumed that good personal hygiene is common sense that will be implemented automatically by all staff. (Sprenger, hygiene for management 2009).

Training of the food handlers are intended to modify or develop knowledge, skills and attitude through learning experience and to achieve effective performance in an activity or range of activities although ignorance may be a factor, most food poisoning incidents are caused by failure of managers and food handlers to implement good hygiene practice. Consequently food becomes contaminated, pathogenic bacteria are provided with the opportunity to multiply or they survive in adequate processing. Hygiene training benefits the food establishment by: (Sprenger, Hygiene for Management, 2009)

- Assisting in the production of safe food.
- Safeguarding the quality of the product and reducing food wastage.
- Reducing complaints.
- Ensuring that all the correct procedure including cleaning are followed.
- Improving supervisory skills of managers.

The study conceals that all of the respondents (100%) reported positive attitudes that, hygiene and safe food handling was an important part of their job responsibilities.

This proved that although most of the factory workers in this study gave positive answers but they might not practice it when handling products.
CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

- Best Food Factory sited in unsuitable location.
- Infrastructure and layout are not meeting the standard hygiene requirements of slaughterhouses.
- Improper monitoring by the authority.
- All the workers challenging lack of knowledge, reflects in their attitude and practice regarding food hygiene.

6.2. Recommendations

1- Providing the top management with trainings on food safety management.

2- Providing the food handlers with further specific training courses according to their role and their level of education.

3- The factory should be strictly monitored by the local authority.

4- Implementation of quality management system (9001/2008).

5- Implementation of a food safety system such as HACCP.
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Jerry Taylor, (2011), Person In Charge, level 3


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Taylor, (2003), definition of Food Borne Illness.

WHO, (2004), definition of Food Hygiene.
Clinical Hospital (GHP) on Best Food Factory – Omdurman Sudan 2014 - 2015

**PART (A)**

**DEMOGRAPHIC CHARACTERISTICS:**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GENDER</td>
<td>Male ( ) Female ( )</td>
</tr>
<tr>
<td>2</td>
<td>AGE (years)</td>
<td>15-20 ( ) 20-25 ( ) 25-30 ( ) More than 30 ( )</td>
</tr>
<tr>
<td>3</td>
<td>NATIONALITY</td>
<td>Sudanese ( ) Not Sudanese ( )</td>
</tr>
<tr>
<td>4</td>
<td>EDUCATIONAL LEVEL</td>
<td>Illiteracy ( ) Primary ( ) Secondary ( ) University ( ) Higher ( )</td>
</tr>
<tr>
<td>5</td>
<td>RELIGION</td>
<td>Muslim ( ) Christian ( ) Other ( )</td>
</tr>
<tr>
<td>6</td>
<td>Duration of Work (year)</td>
<td>less than one ( ) 1-3 ( ) +3-5 ( ) +5-10 ( ) More than 10 ( )</td>
</tr>
<tr>
<td>7</td>
<td>Monthly Salary (SDG/Hundred)</td>
<td>Less than 2 ( ) 2-2.5 ( ) 2.5-3 ( ) 3-3.5 ( ) More than 3.5 ( )</td>
</tr>
<tr>
<td>8</td>
<td>Working Duration (hours)</td>
<td>8 ( ) 9 ( ) 10 ( ) 11 ( ) More than 11 ( )</td>
</tr>
<tr>
<td>9</td>
<td>Place of residence</td>
<td>Inside Premise ( ) Outside Premise ( )</td>
</tr>
</tbody>
</table>

* Please indicate your opinions for the following statements about GHP:

**PART (B)**

**KNOWLEDGE:**

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
<th>DON’T KNOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Do you know GHP stand for what</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Do you know the component of GHP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Lake of GHP will guide to</td>
<td>Less production ( ) More production ( ) Food poisoning cases ( ) Unhygienic environment ( ) Good reputation ( ) Others ( )</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Do you know why to wash your hands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Do you know how milk contaminated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Do you know what is pasteurization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Do you know what is cross-contamination</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Do you know what is the risk associated with raw milk?

Do you know the correct temperature for milk storage?

Do you know shelf life of milk & milk products?

Do you know why we have to make labeling process?

PART (C)

ATTITUDES

<table>
<thead>
<tr>
<th></th>
<th>Agree</th>
<th>Uncertain</th>
<th>Disagree</th>
<th>No answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>Separating raw milk is an important part avoid cross contamination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Applying pasteurization process is very important for killing bacteria</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Storing pasteurized milk on correct storage temperature is very important process</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>By applying proper waste disposal procedure we can avoid bacterial growth &amp; breeding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Pest play strong role on food contamination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Training and learning about food safety is important to me</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Using hairnet, masks, protective gloves and adequate clothing reduce the risk of contamination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Applying stock rotation is very important for food safety</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Improper storage of milk &amp; milk products may be hazardous to health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Food handler with abrasion or cuts finger or hand should not touch ready to eat products</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PART (D)

PRACTICES

Where do you change your dress?
(a) in my residence  
(b) inside restaurant  
(c) inside kitchen  
(d) don't change

What do you do when wash your hands?
(a) wash my hands with soap and water  
(b) wash my hands with water only  
(c) not remember  
(d) don't know

Name the occasion when you wash your hands
(a) before starting my job  
(b) after using the toilet  
(c) before and after touch row foods, utensils, equipments and body  
(d) not remember

Did you smoke, use snuff:
YES ( )  
NO ( )

If yes where
(a) in my residence only  
(b) after finish my duty  
(c) in my break  
(d) between duty
(d) during my duty

36. **Do you wash the garbage container after each disposal**
   (a) Usually
   (b) Sometimes
   (c) Never
   (d) Don’t do

37. **If you get injury in your hand what do you do**
   (a) See doctor
   (b) Dressing
   (c) Ignore and continue my work
   (d) Don’t care

*Thank you for your time and patient & participation on study*
APPENDIX (2):

بسم الله الرحمن الرحيم

Gazira University
Faculty of Health & Environmental Sciences
Master Degree Programme
Evaluation of GHP on Best Food Factory
Omdurman - Sudan
2014 - 2015

<table>
<thead>
<tr>
<th>CHECKLIST</th>
<th>YES</th>
<th>%</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Employees Health Certificates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2  Employees wear clean and proper uniform including shoes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3  Effective hair restraints are properly worn</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4  Fingernails are short, unpolished, and clean (no artificial nails)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5  Jewelry is prohibited</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6  Employees appear in good health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7  Food contact surfaces are properly washed, rinsed, and sanitized</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8  Procedures are in place to prevent cross-contamination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9  Refrigerators are kept clean and organized</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Food Safety Training on place</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Hot water is provided at all times</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Area around dumpsters are clean and odor-free</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Floors walls and ceilings are clean, well maintained and in good repair</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 No evidence of pests is present</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 Toilet facilities are clean, well maintained and in good working order</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 Single service soap &amp; toilet tissue dispensers are full</td>
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<tr>
<td>17 Adequate lighting and ventilation is provided throughout the facility</td>
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<tr>
<td>18 Light fixtures have approved safety covers for providing shatter protection</td>
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</tbody>
</table>
APPENDIX (3):

Photo 5.1: Pest control - insect killer
APPENDIX (4)

Photo 5.2: Protective clothing
APPENDIX (5):

Photo 5.3: Proper hand wash basin