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RESEARCH ARTICLE

A PUBLIC HEALTH EVALUATION OF FOOD SAFETY AND HYGIENE PRACTICES IN MALUTI MOUNTAIN BREWERY, MASERU, LESOTHO

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ABSTRACT

Food safety and good hygiene practices are salient in preventing the risks and hazards that cause food borne diseases, thereby protecting public health. This research examined some issues of food safety and hygiene in one of the main breweries in Lesotho, the Maluti Mountain Brewery. The pH values for tested beer samples ranged from 4.31–4.33 and the pH values for tested soft drink samples ranged from 2.79 – 2.82. The dissolved oxygen values for beer ranged from 0.23 mg/L to 0.25 mg/L (table 1), while the dissolved oxygen values ranged from 0.21mg/L to 0.23mg/L for soft drinks. The packaged beverages are stored at 14°C. The hygiene practices were also generally acceptable. All parameters analysed were within acceptable ranges, except storage temperature that seemed high and requiring an adjustment.

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INTRODUCTION

Food safety is a very important concept (WHO, 1998) that relates to the handling, preparation and storage of food in ways that prevent food borne illnesses, thereby protecting public health. The goal of food safety is to prevent the hazards that cause food borne illnesses and injury. Most of the hazards in food are things that are not easy to see, smell or taste. Food-borne hazards are physical, chemical or biological agents in food or drink that can cause injury or illness (Washington State Department of Health, 2014). Hygiene practices should ensure the cleanliness of places where food processing occurs, including machinery and materials used in the industry (Mothibe, 2013). Surfaces used to place food should be washed, rinsed, and sanitized after each use, to remove germs that can cause illnesses. Other areas like floors and walls should also be kept clean. With breweries, keeping equipment and brewing areas clean helps to reduce workplace incidents and the potential for food contamination (Canadian Center for Occupational health and safety, 2014). Consumers are sometimes ignorant on matters of how the beverages they consume are processed, and whether the right procedures and regulations are being followed during processing. Sometimes, there can be faults or contamination in the processed beverages, which can lead to food borne illnesses such as diarrheal diseases. Brown (2008) highlights that bacteria and viruses are the most common causes of food borne illnesses that largely enter the food supply during food processing or storage. It is documented by the World Health Organization that in 1998 alone 2.2 million people including 1.8 million children died from diarrheal diseases, a great proportion which can be attributed to contamination of food and drinking water. This statistics shows that foodborne illnesses are one of the big killers globally, hence the importance to conduct a research on food safety and hygiene, especially in Lesotho where there is lack of research and documentation on food safety related issues. This research dwelled on looking at some issues of food safety and hygiene practices in one of the main breweries in Lesotho, the Maluti Mountain Brewery. The specific objectives measured the pH, dissolved oxygen and the storage temperatures of the beverages. Also, an assessment of the hygiene conditions during the brewing process was done.

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MATERIALS AND METHODS

This study was undertaken in Maluti Mountain Brewery, a brewing company located at Industrial site, Maseru, Lesotho. Samples were collected fresh from the beverage tanks of maluti beer and soft drinks. They were collected after production to avoid interference, agitation and shakings that might affect the parameters of interest such as dissolved

oxygen in beverages. The samples were collected at different intervals, with the first sample collected right after production and the second sample collected after analysis of the first sample was complete. Collection of samples was done using a clean vessel, where, in each case, the desired amount of sample was drawn for analysis. Two samples of beer and two samples of soft drinks were collected and analyzed on the 23rd, 24th, 27th, 28th and 29th of April 2015. In total, ten samples of beer and ten samples soft drinks were analyzed. The 25th and the 26th were on weekend when the facility did not operate, as it used a discontinuous work calendar. A calibrated portable pH meter (HANNA instruments, United States of America) was used to take the pH values of the samples and dissolved oxygen meter (DO6+ dissolved oxygen/temp. meter by EUTECH instruments, United Kingdom) was used to measure the amount of dissolved oxygen. From each sample, about 40ml was drawn from the collecting vessel into a beaker and a pH meter was inserted to measure the pH of the sample. Following, a dissolved oxygen meter was inserted to measure the amount of dissolved oxygen in the sample. 40ml was a suitable volume, as the probes of the instruments used were able to be adequately covered in that volume, so they could not be exposed to the surrounding air during measurement. A reading on the thermometer mounted in the storage room of the study facility was recorded as the storage temperature of the beverages.

A once off environmental and health and safety inspection of the brewing facility for its hygiene status was done. Proper personal protective equipment was worn before entering the facility. The personal protective equipment used were safety boots, hair net, safety goggles, ear plugs and a lab coat. A hygiene inspection checklist adapted from the University of Greenwich (see APPENDIX) was used during the inspection. The soft drink packaging team leader was interviewed using the questions in the checklist. An orientation was carried out in the facility and observations were made. Of importance in this study were the site cleanliness, disposal of waste, food hygiene, pest control, toilet conditions and washing basins and ventilation of the facility. The inspection was also undertaken to assess the cleanliness of the machinery and materials used in the brewing area. This inspection was conducted on the 30th April 2015. Microsoft excel 2013 was used to process data, and tables and graphs of the results were developed.

RESULTS AND DISCUSSION

The pH values for tested beer samples ranged from 4.31 – 4.33 as shown in table 1 and the pH values for tested soft drink samples ranged from 2.79 – 2.82 as shown in table 2. According to Riikka et al. (2011), food borne pathogens do not generally grow at pH 4.6 or below and, therefore, the pH of soft drinks and alcoholic beverages is adjusted below 4.6 to prevent the growth of pathogens in these beverages. So, these pH values are found to be within an acceptable range. The dissolved oxygen values for beer ranged from 0.23 mg/L to 0.25 mg/L (table 1), while the dissolved oxygen values ranged from 0.21mg/L to 0.23mg/L for soft drinks, as shown in table 2. According to Sachon (2008), the expected dissolved oxygen amount in packaged beer is 0.02mg/L-0.25mg/L, meaning that the dissolved oxygen values for beer are found to be within an acceptable range. Furthermore, maximum oxygen concentration allowed in beer is 1mg/L, since higher concentrations affect the flavor of the product (Huber et al., 2006). This limit of 1mg/L can also apply to soft drinks because all beverages are sensitive to high dissolved oxygen (Emerson process management, 2014).

Table 1. pH values and dissolved oxygen measurements of Maluti beer, during the study period

Sample	Sampling date	pH	Dissolved oxygen(mg/L)
1	23/04/2015	4.33	0.24
2	23/04/2015	4.33	0.25
3	24/04/2015	4.32	0.24
4	24/04/2015	4.31	0.24
5	27/04/2015	4.32	0.23
6	27/04/2015	4.32	0.24
7	28/04/2015	4.33	0.25
8	28/04/2015	4.32	0.25
9	29/04/2015	4.31	0.25
10	29/04/2015	4.32	0.25

Table 2. pH values and dissolved oxygen measurements of soft drinks, during the study period

Sample	Sampling date	pH	Dissolved oxygen (mg/L)
1	23/04/2015	2.82	0.23
2	23/04/2015	2.81	0.23
3	24/04/2015	2.81	0.21
4	24/04/2015	2.81	0.21
5	27/04/2015	2.80	0.22
6	27/04/2015	2.79	0.21
7	28/04/2015	2.80	0.22
8	28/04/2015	2.78	0.21
9	29/04/2015	2.79	0.21
10	29/04/2015	2.81	0.21

The packaged beverages are stored at 14°C at Maluti Mountain brewery. According to Wikihow (2015), most beer is stored at a temperature around 10°C-12.8°C. The storage temperature for packaged products should be maintained at or below 7.22°C (Penn State Creamery, 2014). The storage temperature of the facility at Maluti mountain brewery is a bit high compared to what the literature stipulates. When inspecting the cleanliness of the facility, it was found that the work surfaces, shelves and floor are kept clean and tidy and the walls and ceilings are clean and in good condition (not chipped or peeled). All surfaces are easy to wash, equipment and utensils are cleaned thoroughly after use and sinks and drains are working properly (not blocked). Furthermore, deep cleaning is carried out regularly in the facility. It was observed that the goods delivery area is also kept clean and free from clutter. Under the category of disposal of waste, it was found that waste food and other waste are removed from the production facility at least once per day. The waste is stored in a bin with a tight-fitting lid and refuse bins are kept a distance from the production area. Broken glass are not put in a puncture-proof container or wrapping before disposal into a bin. Concerning food hygiene, it was found that staff members are trained in basic hygiene practices. Food deliveries are attended to immediately. The refrigerators and freezers are clean and working properly and other cool storage areas (cold rooms) have temperatures below 10°C. For pest control, the production area and storage areas are regularly checked for pests (mice, insects etc.). There is a pest control company employed to control pests in the facility and the name of the pest control company is Rent to Kill company. For toilet conditions and washing basins, it was found that there were enough toilets for both men and women (staff). The toilets and wash basins are clean, are in working order and have hot and cold running water, with soap and towels being provided. There are lockers provided for staff clothing and bags and

there is a dedicated area away from the production area, where staff can sit, eat and drink. For ventilation of the facility, brewing smells and steam are removed from the facility, there is supply of fresh air with no draughts and there are mechanical extractor ventilation systems installed, which are checked and maintained annually.

In the hygiene inspection checklist, 24/28(86%) of the questions were answered with a Yes, 2/28 (7%) of the questions were answered with a No and 2/28 (7%) of the questions were answered with Not applicable (N/A). This means that 86% of the requirements used in this to evaluate the hygiene status of the facility were met, 7% of the requirements were not met and another 7% was not catered for in the facility.

CONCLUSION AND RECOMMENDATIONS

The facility was found to be in a very clean state and equipment and utensils used were in a very clean condition. Good hygiene practices were observed and appropriate storage temperatures of storage rooms and refrigerators were maintained. Proper initiatives were taken for pest control in the facility. Waste generated in the facility was well managed and well-disposed of, except for broken glass. Toilets and washing basins were in a very good condition as well and the ventilation of the facility was up to mark. The facility also possesses a good hygiene status. The storage temperature was found to be a bit high compared to the recommended temperatures in the literature. This storage temperature is unsuitable for beverages and can affect the quality of the beverages.

The following recommendations are given:

1. The storage temperature of packaged beverages has to be lowered to at least 7°C to preserve the quality of the beverages and to inhibit microbial activity in the beverages.
2. Broken glass should be put in a puncture proof container or wrapping before disposal to avoid incidents where the employees or people responsible for waste management may be injured by and glass.

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APPENDIX: KITCHEN INSPECTION CHECKLIST

Use this checklist to inspect food preparation areas, associated storage areas and seating areas.
The answer to all these questions should be "yes". If "no" you should note the location and brief details and investigate the problem further to identify actions.

Areas inspected……..
Inspected by…… Date……..

Hazard	Yes/no	Comments	Action taken or recommendation (with completion date)
CLEANLINESS			
Are work surfaces, shelves and floor kept clean and tidy?			
Are walls and ceilings clean and in good condition (not cracked, chipped or peeled)?			
Are all surfaces easy to wash down?			
Are equipment and utensils cleaned thoroughly after use?			
Are sinks and drains working properly? (not blocked or smelling)			
Is deep cleaning carried out regularly? (Note when last carried out).			
Is the goods delivery area kept clean and free from clutter?			
DISPOSAL OF WASTE			
Are waste food and other waste removed from the kitchen (production area) atleast once per day?			
Is waste stored in a bin or similar container with a tightly fitting lid?			

Continue……..

Are broken glass and other sharp waste put in a puncture-proof container or wrapping before disposal into a bin?	
Are refuse bins kept at a distance from the kitchen?	
Are refuse bins emptied regularly?	
FOOD HYGIENE	
Are staff trained in basic hygiene practices (check training records)	
Are food deliveries attended to immediately?	
Are refrigerators and freezers clean and working properly? (freezer temp -18°C or less)	
Are other cool storage areas below 10°C?	
PEST CONTROL	
Are kitchen (production area) and storage areas regularly checked for pests (mice, insects, etc.) infestations? (note date of last check and name of pest control company)	
Are pest control visits made out of hours e.g. at night?	
Are fly screens in place at all opening windows and vents?	
Are electric fly killer units in working order & maintained regularly?	
TOILETS AND WASHING BASINS	
Are there enough toilets for men and women? (not for customer use)	
Are toilets and wash basins clean and in working order?	
Are hot and cold (or warm) running water, soap and towels (or other cleaning/hand drying facilities?	
Are lockers provided for staff clothing and bags?	
Is there a rest area away from the production area, where staff can sit, eat and drink?	
VENTILATION	
Are brewing smells and steam removed from the room?	
Is there a supply of fresh air with no draughts?	
Are mechanical extract ventilation systems checked and maintained annually?	

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