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Hygiene sanitation aspect and drinking water quality of Kerawang Depots, Lampung

Ganis Ayu Winanti[1], Sarto[2], Wiranto[1]

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[1]Department of Health Behavior, Environmental, and Social Medicine, Faculty of Medicine, Public Health, and Nursing, Universitas Gadjah Mada, Indonesia

[2]Department of Chemical Engineering, Universitas Gadjah Mada, Yogyakarta, Indonesia

*Correspondence:
Ganis Ayu Winanti
ganisayu96@mail.ugm.ac.id

Abstract

Purpose: Healthy and safe refillable drinking water must comply with the Regulation of the Minister of Health of the Republic of Indonesia (RI) number 43 of 2014 and 492/MENKES/Per/IV/2010.Increasing drinking water coverage in Lampung Province makes Kerawang water an alternative to meet drinking water needs because it is cheap, easy to access, and practical. This study aims to analyze the hygiene and sanitation of the Kerawang water depot. **Methods:** This qualitative study used a case study approach. Informants were recruited through the purposive sampling technique. The primary informants are 6, the touchers of the depots. One supporting informant was the Ambarawa Health Center's environmental health officer. **Results:** Of the 17 depots observed, 3 (17.64%) water depots did not meet the requirements, and 14 (82.35%) met the criteria. Of the 17 depots that had been checked the quality, 17 (100%) depots were appropriate for the physical requirements, 11 (64,70%) depots were not suitable for the chemical requirements, two depots (11.76%) were not appropriate for the biological requirements. **Conclusion**: The infrastructures were cleaned at different times, and there was some lack of basic sanitation facilities. Equipment for the water treatment process was always replaced before the expiration. Some handlers did not check their health and apply hygiene behaviors. Depot owners must complete basic sanitation facilities such as handwashing stations, trash cans, and closed sewers, facilitate work clothes and health checks, control the hygiene behaviors of handlers, and conduct regular quality checks on drinking water.

Keywords: drinking water quality; hygiene sanitation; Kerawang

INTRODUCTION

Water is the main component on earth that is inseparable for all living things to maintain their survival [1]. Every individual has a water right that is sufficient, sustainable, safe, satisfactory (quality), easy to access, and affordable for personal and household needs [2]. Water supply sources can come from surface water such as river water, lake water, groundwater, recording water, reservoir water, rainwater, desalination of seawater or brackish or saltwater, and water from wastewater treatment [3]. According to the World Health Organization (WHO), in 2017, as many as 71% of the world's population (5.3 billion individuals) utilized clean water services manager safely as a drink

such as water. From 2000 to 2017, the number of individuals using safe drinking water services increased by 1.7 billion people per year [2]. In 2015, Indonesia showed that access to drinking water was 71.14% and continued to rise consistently until 2019 to 89.27% [4]. A consistent increase also occurred in Lampung province from 2013 to 2017, with a percentage increase from 2013 of 63.98%, 2015 at 68.57%, and 2017 at 72.83%, and the increase occurred in Pringsewu Regency from 2013 of 58, 76%, 2015 at 63.92% and 2017 at 69.71% [5].

The alternative the community chooses to fulfill drinking water needs is refilled water because of its low price, easy access, and practicality [6]. The refill drinking water depot carries out hygiene and sanitation activities to minimize the contamination factor of drinking water. Aspects of sanitation hygiene include place, equipment, and handlers [7]. In addition, drinking water depots must conduct regular quality inspections of drinking water by physical, chemical, and biological parameters to ensure that the water produced is safe for consumption [8].

Kerawang village has natural resources in the form of groundwater in the mountains, which is used as raw material for drinking water. Kerawang water is one of the most extensive supplies for fulfilling drinking water needs. Uniquely, all Kerawang water depots are in one area and sell their products using large 20-25 liter jerry cans.

The result of a preliminary study at two water depots in Kerawang showed that several items did not meet the requirements according to Permenkes RI No. 49 Tahun 2014, such as not cleaning jerry cans, filling drinking water in an open room, not having a handwashing area, and the handlers not implementing sanitation hygiene behavior. These problems are at risk of contamination that can reduce drinking water quality and cause consumer disease.

METHODS

This qualitative study used a case study approach. Data in qualitative research are transcripts of interviews, photos, and videos. Then, the data will be analyzed by description and interpretation using words and pictures [9]. This qualitative research aimed to see the Kerawang water depots' sanitation hygiene according to the aspect of the place, equipment, and handlers based on Permenkes RI Nomor 43 tahun 2014 and water drinking quality based on Permenkes RI 492/MENKES/Per/IV/2010. This research was conducted in 17 water depots in Kerawang. Research informants were obtained through the purposive sampling technique. The primary informants were six handlers of the Kerawang water depots and one support informant, the Environmental Health Officer. The research data was collected through interviews, observation, and secondary data collection in archives of data on drinking water quality from the Ambarawa Health Center.

RESULTS

The place aspects of Kerawang water depots

The place was cleaned and maintained at different times, including infrastructure, floors, walls, roofs, ceilings, and ventilation. The completeness of basic sanitation facilities such as restrooms, sewerage, hand washing, and trash bins still needs to be improved.

"It depends on how dirty it is; if it's dirty, then clean it" (informant 3).

"I borrow the bathroom at the house next door" (informant 3).

"There's nothing, miss. If you want to wash your hands, you can use the tap" (informant 5).

The observations showed that, according to the aspect of place, only 1 point was appropriate to the requirements, while the other 16 points were not.

The equipment aspects of Kerawang water depots

The equipment used to process water was a filter, carbon, and ultraviolet. Each depot's Kerawang water treatment steps differ depending on the equipment used.

"The process goes from the well to the filter, then to the reservoir, then filtered again, then to the carbon, then to the final filtration, then through UV light, and finally to the reservoir ready for jerricans" (informant 2).

The observation results according to the equipment aspect showed that 7 points were appropriate with the requirements while the other 4 points were not appropriate with the requirements.

The handler aspects of kerawang water depots

Not all handlers carry out regular health checks, do not apply sanitation hygiene, and have not attended hygiene sanitation courses.

"But if someone shows symptoms of illness... there's a lack of initiative to go for a checkup themselves..." (informant 2).

The observations showed that according to the aspects of the handler, only 2 points were appropriate to the requirements, while the other 5 points were not appropriate to the requirements.

Results of Kerawang water quality inspection

The physical examination results of 17 depots correspond to the threshold value. Chemical test results showed that the pH parameter at 11 depots exceeded the threshold value. A biological examination revealed that two depots were contaminated with E. coli.

"The problem is the pH is low, all below the limit…" (informant 7).

"The physical examination is all good... all the parameters meet the quality standards" (informant 7).

"The UV equipment is broken... it turns out everything is because of the electricity" (informant 7)

Table 1. Observation results based on aspects of the place, equipment, and handlers of refillable drinking water depot requirements

Description	Results			
	Appropriate		Not appropriate	
	n	%	n	%
Place				
Location free from pollution and disease transmission	14	82,35	3	17,64
Strong building, safe, easy to clean, and easy to maintain	14	82,35	3	17,64
The floor is a waterproof, flat surface, smooth, not slippery, not cracked, does not absorb dust, and is easy to clean, and the slope is entirely ramped	9	52,94	8	47,05
Walls are waterproof, flat surface, smooth, non-slippery, non-cracking, dust-absorbing, and easy to clean, and bright and bright colors	15	88,23	2	11,76
The roof and ceiling must be strong, anti-rat, easy to clean, not absorb dust, have a flat surface and light color, and have a sufficient height	15	88,23	2	11,76
The layout consists of processing, storage, sharing/provisioning, and visitor/consumer waiting rooms	16	94,11	1	5,88
Lighting bright enough to work, not blinding, and evenly spread	17	100	0	0
Ventilation ensures good air circulation/exchange	7	46,66	10	58,82
Humidity can provide comfort in doing work/activities	16	94,11	1	5,88
Have access to restrooms	15	88,23	2	11,76
There is a sewer that flows smoothly and is closed	0	0	17	100
There is a closed trash bin	1	5,88	16	94,11
There is a hand-washing area equipped with running water and soap	2	11,76	15	88,23
Free from mice, flies, and cockroaches	17	100	0	0
Equipment				
The equipment used is made of food-grade	17	100	0	0
Microfilters and disinfection equipment are not expired	17	100	0	0
Raw water reservoirs must be closed and protected	17	100	0	0
Cleaning containers/gallons before filling	17	100	0	0
Containers/gallons that have been filled with drinking water must be given directly to consumers and should not be stored on DAM for more than 1x24 hours	17	100	0	0
Performing reverse washing system (backwashing), replace macro filter tubes periodically	17	100	0	0
There is more than one microfilter (μ) with a tiered size	12	70,58	5	29,41
There is sterilization equipment in the form of ultraviolet ozonization or other disinfection equipment that is functioning and used correctly	11	64,70	6	35,29
There are bottle washing and rinsing facilities (gallons)	17	100	0	0
There is a bottle-filling facility (gallon) in a closed room	0	0	17	100
New clean bottle caps are available	14	82,35	3	17,64
Handlers				
Healthy and free from infectious diseases	17	100	0	0
Not being a carrier of germs	17	100	0	0
Practicing hygiene and sanitation every time serving consumers	8	47,05	9	52,94
Always wash your hands with soap and running water every time serving customers	0	0	17	100
Using clean and tidy work clothes	1	5,88	16	94,11
Conducting regular health checks at least 1 (one) time a year	1	5,88	16	94,11
The operator/person in charge/owner has a certificate of having attended a drinking water depot sanitation hygiene course	11	64,70	6	35,29

Table 2. Kerawang water quality based on physical, chemical, and biological parameter

Parameter standards		Unit Quality	Results			
			< Quality standards		> Quality standards	
			n	%	n	%
Physical parameter						
Smell	-	No smell	17	100	0	0
Color	TCU	15	17	100	0	0
TDS	Mg/l	500	17	100	0	0
Turbidity	NTU	5	17	100	0	0
Temperature	^{0}C	temperature ± 3	17	100	0	0
Chemical parameter						
Aluminum	mg/l	0,2	17	100	0	0
Iron	mg/l	0,3	17	100	0	0
Chloride	mg/l	1,5	17	100	0	0
Hardness	mg/l	500	17	100	0	0
Chloride	mg/l	250	17	100	0	0
Manganese	mg/l	0,4	17	100	0	0
Nitrates (NO3-)	mg/l	50	17	100	0	0
Nitrite (NO2-)	mg/l	3,0	17	100	0	0
pH	-	6,5-8,5	6	35,29	11	64,70
Sulfate	mg/l	250	17	100	0	0
Organic matter	mg/l	10	17	100	0	0
Biological parameter						
E.coli	amount per 100 ml sample	0	15	88,23	2	11,76
Coliform	amount per 100 ml sample	0	17	100	0	0

DISCUSSION

The place aspects of Kerawang water depots

The condition of the cracked floor is stagnant, and the water is difficult to clean. This situation caused the floor to be unable to dry and can be dusty. The existence of ceiling functions to prevent dust from the roof, does not stick and does not fall directly into the depot, and is easier to clean [10]. Good air exchange makes the depot more comfortable, increasing work productivity [11]. Having restroom facilities in the depot is vital to a healthy building [10]. The existence of an open sewage channel causes inundation, which can be at risk of becoming a breeding ground for disease vectors [12]. The existence of waste that is not covered and scattered is one of the critical roles in the spread of disease and the decrease in drinking water quality [13]. Handlers must wash their hands before contacting the product [14].

The equipment aspects of Kerawang water depots

Tools used for drinking water treatment, such as pipes, water reservoirs, bottle washes, filters, carbon, and UV, are essential aspects that are considered because they affect water quality [15]. The filter's function is used to filter contamination in water. UV light functions as water sterilization, ensuring water quality is safe and suitable for consumption [16]. UV sterilizers' work is to disable microorganisms by damaging DNA and RNA and inhibiting the reproductive system from killing microorganisms. Ultraviolet radiation ranges from 200-400 nm, and effective wavelengths for killing microorganisms range from 254-260 nm [10].

The handler aspects of Kerawang water depots

Handlers who do not carry out regular health checks cannot guarantee that they are healthy, free from infectious diseases, and not carriers of disease germs [17]. Handlers who do not practice hygiene are at risk of microbiological contamination of drinking water [14]. The handlers' involvement in the sanitation hygiene course will affect their practice when applying sanitation hygiene [10].

Results of Kerawang water quality inspection

Physical parameters include smell, color, TDS, turbidity, and temperature. Smell and color can be known through smell and vision [18]. High TDS will affect the taste. High turbidity is directly proportional to the increase in TSS. Temperature parameters that exceed the threshold value occur due to microorganisms' decomposition of organic matter [19].

Chemical parameters include aluminum, iron, fluoride, chloride, manganese, nitrates, nitrites, pH, sulfates, and organic matter. pH that is less than and exceeds the threshold value can cause chemical compounds to turn into toxins that negatively impact health. Excess nitrites lead to the formation of methemoglobin, which can block oxygen in the body. Iron elements in water can cause odors and colors in drinking water. Manganese elements will give a smell and taste to drinking water. Organic substances in

drinking water indicate the occurrence of physical characteristics of water, such as color, smell, taste, and turbidity. Hardness suggests the formation of one [18]. Chloride compounds affect the salty taste of drinking water and high levels of nitrates in drinking water cause blue baby syndrome. The high sulfate concentration causes odor and corrosion in pipes [20]. High fluoride in water causes dental fluorosis, digestive disorders, and dehydration. If it is acute, it can cause bone defects, paralysis, and death [21]. Drinking water with aluminum content that exceeds the threshold value can cause several diseases, such as dementia and Alzheimer's [22]. Biological parameters indicate the presence or absence of microorganisms such as bacteria, viruses, E. coli, benthos, and plankton [23]. The presence of E.coli in drinking water indicates that drinking water is contaminated by the feces of humans or warm-blooded mammals [24].

CONCLUSION

Sanitation hygiene of 17 Kerawang water depots based on aspects of place, equipment, and handlers, based on the Permenkes RI Nomor 43 Tahun 2014, showed that out of 17 Kerawang water depots, 3 (17.64%) depots were not appropriate with the requirements, and 14 (82, 35%) depots were appropriate with the requirements.

The results of the inspection of Kerawang water quality based on physical, chemical, and biological parameters based on the Permenkes RI Nomor 492/MENKES/Per/IV/ showed out of 17 depots on physical parameters, 17 (100%) were appropriate with the requirements. Chemical parameters on pH examination showed 11 (64.70%) depots inappropriate to the requirements. Biological parameters: 2 (11.76%) depots inappropriate to the requirements were contaminated with E.coli bacteria.

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