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Physical Examinations, Chemicals and Microbiology on Drinking Water Refill

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Abstract--Humans use water to support life. The objective of the study was to know the quality of hygiene and sanitation, physical quality (Odor, Color, TDS, Flavor, Turbidity, Temperature), chemical (Arsenic, Flouride, Total Chromium, Cadnium, Nitrate, Nitrite, Cyanide, Aluminum, Fe, Chloride, Manganese, Ammonium), and microbiology (Total Bacteria Coliform and E.Coli) on Drinking Water Refill (DAMIU) in work area of Puskesmas Lingkar Barat Bengkulu City on 2017. This research type was descriptive, qualitative and quantitative. Population and sample in this research were entrepreneur of Depot of Drinking Water Refill in work area of Puskesmas Lingkar Barat Bengkulu City as much as 12 DAMIU. Technique data analysis of drinking water quality data was conducted univariat by describing the characteristics of each research variable based on the standard method of Regulation of the Minister of Health of the Republic of Indonesia No. 43 of 2014 on Sanitation Hygiene of Drinking Water Refill Depot (DAMIU) and Number 492/2010 on Water Quality Requirements. More than 7 (58.67%) of DAMIU meet sanitary hygiene requirements, the results of inspection of refill drinking water available at DAMIU physically and chemically 100% meet drinking water health requirements, and more than some (66.67%) of DAMIU in the work area of the Puskesmas Lingkar Barat Bengkulu City were microbiologically eligible for consumption. Suggestions can be taken into consideration for local government and health center to monitor the quality of refill drinking water more and more circulating in the community to be guaranteed quality of quality and safety.

Keywords: Sanitation Hygiene, Physical Quality, Chemistry, and Microbiology.

I. INTRODUCTION

Water is one medium of disease mediators to reach humans. Water entering into the human body either in the form of drinks or food should not cause disease or is not a carrier of disease seeds. Water treatment from sources, transmission or distribution networks is absolutely necessary to prevent contact between water and sewage as a source of disease (Haryanti, et al, 2006). Water demand in developed countries is filled with drinking water, whereas in developing countries drinking water is only used for food and drink. WHO (2011), calculates that the water needs of people in developing countries (rural), including in Indonesia between 30-60 liters / person / day, while in developed or urban countries require 60-120 liters / person / day. Along with the increasingly advanced technology accompanied by the increasingly busy human activity, people tend to choose a more practical way with a relatively cheaper cost in meeting the needs of drinking water. Meeting the needs of drinking water is an alternative that is by using refill drinking water (Asmadi, 2011).

The need for drinking water triggered a large number of refill drinking water depots. Consumers or people who use refill water as a cheap alternative to meet the needs of drinking water need protection. Therefore, the Minister of Health issued Circular Letter Number 860/Menkes/VII/2002 on the Development and Supervision of Hygiene Sanitation Drinking Water Refills Depot. Knowledge in the operation of incomplete refill drinking water depot business, such as disinfection, gallon washing, and rinsing will lead to hazardous pollution and also affect the quality of drinking water (Navis, 2014). Result of examination of physical and chemical quality of refill drinking water in South Kuta subdistrict, Bandung regency, Bali has not fulfilled health requirement according to Minister of Health Regulation No. 492 / MENKES / PER / IV / 2010 (Dewa et al, 2012). Microbiological requirements are also not met on the quality of drinking water produced by DAMIU in Bungus Padang Subdistrict (Rido et al, 2012).

Following the circular letter Bengkulu City Health Office routinely has conducted supervision and guidance to producers / DAMIU in its report states as many as 335 pieces, which does not meet the requirements 41 (12.23%), where the work area of Districts Gading Cempaka is one of the does not meet sanitary hygiene requirements (Dinkes Kota Bengkulu, 2015). In Districts Gading Cempaka there are 43 refill drinking water depots divided into three health centers, namely Gedang Road Health Center as many as 15 DAMIU, Lingkar Barat Health Center as many as 14 DAMIU, and Sidomulyo Health Center as many as 14 DAMIU. Unfortunatelly, as much as 13.8% do

not meet sanitary hygiene requirements (Dinkes Kota Bengkulu, 2015).

Based on Data of Lingkar Barat Health Center Bengkulu City (2016), the number of DAMIU as many as 14 pieces, with the details of refill drinking water depot that has no license 5 pieces and 9 pieces already have permit but no longer valid. Whereas the owner of the drinking water depot is the most responsible person in the drinking water depot business. Therefore, the owner must know hygiene sanitation drinking water depots. This is necessary so that drinking water depot owners can better understand and apply good production methods, so that the community is not harmed by the distribution of drinking water from drinking water depots that do not meet the health requirements in accordance with Minister of Health Regulation No. 492 / MENKES / PER / IV / 2010 on Water Quality Requirements. The aims of this research were to know the quality of hygiene and sanitation, physical quality (Odor, Color, TDS, Flavor, Turbidity, Temperature), chemical (Arsenic, Flouride, Total Chromium, Cadnium, Nitrate, Nitrite, Cyanide, Aluminum, Fe, Chloride, Manganese , pH, Ammonium), and microbiology (Total Bacteria Coliform and E.Coli) at DAMIU in the work area of West Lingkar Puskesmas Bengkulu City 2017.

II. METHODS

This research type was descriptive, qualitative and quantitative analytic. The refill drinking water sample is tested in the laboratory to get an idea of whether the refill drinking water is in compliance with the physical quality requirements (Odor, Color, TDS, Turbidity, taste, and temperature), chemical (Arsenic, Flourida, Chromium, Nitrate, Nitrite, Aluminum, Fe, Chloride, Manganese, pH, and Ammonium), and microbiology (Total Bacteria of Coliform and E. coli). Population and sample in this research all DAMIU entrepreneurs in work area of West Lingkar Puskesmas Bengkulu City which amount to 12 pieces. The sample examination was conducted at Integrated Laboratory of Poltekkes Kemenkes Bengkulu. Data analysis was done univariat, while the quality of drinking water was analyzed descriptively using Standard Method of Regulation of the Minister of Health of the Republic of Indonesia No. 492/2010 on Water Quality Requirement.

III. RESULT

The results of sanitary hygiene inspection inspection at DAMIU in West Lingkar City Bengkulu Health Working Area and physical, chemical, and microbiological water quality inspection at Poltekkes Integrated Laboratory of Kemenkes Bengkulu are presented in the following frequency distribution form.

Results of Inspection of Hygiene Inspection Sanitation Drinking Water Refill Depot

Table 1 Distribution of Frequency of Inspection Result of Hygiene Sanitation Inspection at DAMIU in Work Area of Lingkar Barat Health Center of Bengkulu City 2017

Inspection Sanitary Hygiene	Unit	DAMIU Sanitation Hygiene Test Results											
		A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**
The place	28	20	21	19	17	23	17	18	15	25	18	15	25
Equipment	29	27	26	28	26	26	26	23	25	24	24	18	26
Handler	18	11	12	6	13	12	8	9	8	13	8	6	15
Raw Water / Drinking Water	25	17	25	17	17	25	25	19	17	25	17	17	17
Number of Skore Values	100	75	84	**70**	73	86	76	**69**	**65**	87	**67**	**56**	83
Information		MS	MS	**TMS**	MS	MS	MS	**TMS**	**TMS**	MS	**TMS**	**TMS**	MS

M MS=Eligible, if the total examination value is> 70
TMS=Not Eligible, if the examination value is <70

Table 1 shows that the quality of DAMIU sanitation hygiene in the work area of Lingkar Barat Health Center eligible for 7 (58.33%) and unqualified 5 (41.67%) is below the minimum level specified in Permenkes Number: 43 Year 2014 on Hygiene Sanitation Drinking Water Depot.

Laboratory Result of Physical Quality Inspection of Drinking Water Refill

The results of laboratory examination of physical quality of refill drinking water based on the maximum permissible level of Regulation of the Minister of Health No. 492 / Menkes / Per / IV / 2010 can be presented in the following frequency distribution table.

Table 2. Frequency Distributionof Physical Quality Result Inspection at DAMIU for Sale in Work Area of Lingkar Barat Health Center of Bengkulu City 2017

Physical Parameters	Unit	KMP	DAMIUExamination Results									
			A	B	C	D	E	F	G	H	I	Description
Smell	-	Tbb	Tbb	Tbb	Tbb	Tbb	Tbb	Tbb	Tbb	Tbb	Tbb	MS
Colour	TCU	Tbw	Tbw	Tbw	Tbw	Tbw	Tbw	Tbw	Tbw	Tbw	Tbw	MS
Total Solids (TDS)	mg/l	500	70	68	15	10	14	67	180	70	67	MS
Turbidity	NTU	5	0,43	0,43	0,14	0,97	0,17	0,43	0,28	0,49	0,11	MS
Taste	-	Tbr	Tbr	Tbr	Tbr	Tbr	Tbr	Tbr	Tbr	Tbr	Tbr	MS
Temperature Des	^{o}C	+ 3	31,3	24,2	25,7	26,4	24,3	30,8	31,4	28,4	28,4	MS

Description :MS : Qualify
TMS : Not Eligible
Tbb : No Smell
Tbw : Not Colored
Tbr : Not Taste

Table 2 shows that the physical quality of refill drinking water in the work area of West Lingkar Puskesmas of Bengkulu City is 100% to meet the physical quality requirements of drinking water. It is known from the result that the physical parameters examined are still below the maximum limit specified in Minister of Health Regulation No. 492 / Menkes / Per / IV / 2010.

Results Laboratory of Water Quality Inspection of Drinking Water Refills

The results of examination of chemical quality parameters in refill drinking water in the work area of Lingkar Barat Health Center of Bengkulu City include Arsen, Flourida, Total Chromuim, Nitrite, Nitrate, Cyanide, Aluminum, Iron, Manganese, pH, and Ammonium. Table 3 below is a detailed examination result.

Table 3. Frequency Distribution of Chemical Quality Inspection Result at DAMIU for Sale at Work Area of West Lingkar Puskesmas Bengkulu City 2017

Parameter Kimia	Unit	KMP	DAMIU Inspection Results									
			A	B	C	D	E	F	G	H	I I	KET
Arsenic	mg/l	0,01	< 0	< 0	< 0	< 0	< 0	< 0	< 0	< 0	< 0	MS
Florida	mg/l	1,5	0,1	0,27	1,4 0	0,490	0,49	0,32	0,30	0,49	0,51	MS
Total Chromium	mg/l	0,05	0,03	0,02	0,03	0,04	0,03	0,080	0,14	0,03	0,03	MS
Cadnium	mg/l	0,003	< 0	< 0	< 0	< 0	< 0	< 0	< 0	< 0	< 0	MS
Nitrate (NO2-)	mg/l	3	0,28	0,19	0,21	0,21	0,24	0,23	0,28	0,22	0,21	MS
Nitrite (NO3-)	mg/l	50	0,9	1,1	1,2	1,2	1,0	1,0	1,0	1,3	1,1	MS
Cyanide	mg/l	0,07	< 0	< 0	< 0	< 0	< 0	< 0	< 0	< 0	< 0	MS
Aluminum (Al)	mg/l	0,2	< 0	< 0	< 0	< 0	< 0	< 0	< 0	< 0	< 0	MS
Iron (Fe)	mg/l	0,3	0,22	0,20	0,16	0,16	0,18	0.21	0,28	0.16	0,19	MS

Chloride	mg/l	250	42	74	54	60	98	19	16	61	78	MS
Manganese (Mn)	mg/l	0,4	0,19	0,22	0,11	0,24	0,23	0,15	0,22	0,28	0,20	MS
pH	-	6,5 - 8,5	8,2	6,9.1	7,9	6,8	6,6	6,9	7,9	6,8	7,2	MS
Ammonium	mg/l	1,5	0,01	0,03	0,05	0.01	0,01	0,01	0,22	0,01	0,03	MS

Description: KMP = Maximum allowed level
MS = Qualifies
TMS = Not Eligible

Table 3 shows that the results of examination of chemical quality of refill drinking water in the work area of West Lingkar Puskesmas Bengkulu City 100% all meet the requirements of drinking water chemistry quality, because of the chemical parameters examined the levels are still below the maximum levels set at Permenkes No. 492 / Menkes / Per / IV / 2010.

Laboratory Result of Microbiology Quality Inspection of Mium Refill Water

The results of microbiological quality inspection of refill drinking water at drinking water depots sold in West Lingkar City Puskesmas Bengkulu include Coliform and E. Coli bacteria, using Most Probable Number (MPN) method. The results can be seen in table 4 below.

Table 4. Distribution of Frequency of Microbiology Quality Inspection Result at DAMIU in Working Ward of West Lingkar Puskesmas Bengkulu City 2017

Parameter Mikrobiologi	Satuan	KMP	Hasil Pemeriksaan DAMIU								
			A	B	C	D	E	F	G	H	I
E.Coli	Jumlah per 100 ml per sampel	0	0	0	**130**	0	0	0	**16**	**6,7**	0
Total Bakteri Coliform	Jumlah per 100 ml per sampel	0	0	0	**250**	0	0	0	**75**	**11**	0
Keterangan			MS	MS	**TMS**	MS	MS	MS	**TMS**	**TMS**	MS

KMP = Maximum allowed
MS = Qualified
MS = Not Eligible

Table 4 shows that the results of microbiological quality checks on refill drinking water sold in the West Lingkar Bengkulu district health work area from 9 samples taken, there are 3 positive samples (C, G, and H) and 6 negative samples (A, B, D, E, E, and I) that meet drinking water quality requirements, since the parameters examined are still below the maximum limit specified in Permenkes No. 492 / Menkes / Per / IV / 2010.

IV. DISCUSSION

Inspection of Hygiene Inspection Sanitation Drinking Water Refill Depot (DAMIU)

Based on the inspection result of hygiene sanitation inspection in table 1 it is known that the quality of sanitation hygiene of DAMIU in the work area of West Lingkar Clinic which fulfill the requirement is 7 (58,33%) and that not yet fulfill requirement 5 (41,67%) that is under limit the minimum level set at the Minister of Health Decree Number 43 Year 2014 on Hygiene Sanitation Drinking Water Depot, this is because there is still access to bathrooms and latrines in the house as much as 8 (66%), sewerage as much as 9 (75%) , not yet equipped with hand washing with running water and soap as much as 11 (91,66%), still existence of drinking water depot which hold water gallon more than 24 hours as much as 5 (41,66%), and still the handler who use work clothes less hygeinis as much as 5 (41.66%).

This sanitation hygiene condition may change at any time if the employer obeys and applies every aspect of assessment included in Permenkes Number 43 Year 2014, ie place / location, equipment, handler, raw water and drinking water. According to Navis (2014), knowledge in the operation of incomplete drinking water refill business depots, such as disinfection, gallon washing, and rinsing will lead to hazardous pollution and also affect the quality of drinking water.

Physical Quality Inspection of Drinking Water Refills

The result of organoleptic analysis in Integrated Laboratory of Poltekkes Kemenkes Bengkulu, based on table 2

it is known that the physical quality of DAMIU in the work area of West Lingkar City Health Center of Bengkulu from 9 samples examined entirely 100% fulfill the health requirement according to Minister of Health Regulation No. 492 / MENKES / PER / IV / 2010. The regulation states that water that is suitable for use is water that has good quality as drinking water, among others, must meet physical requirements, odorless, tasteless, and colorless.

Drinking water that smells other than aesthetic is not accepted by the public. The smell of water can signal the quality of drinking water, the smell of rancid usually due to the presence of algae. Water usually does not taste or bargain. Undesirable water may indicate the presence of harmful substances in health. Odor and taste can be generated by the presence of aquatic organisms and the presence of gases such as H2S. Water must be colorless, water for the sake of the household must be clear, colored water means to contain ingredients that are harmful to health (Soemirat, 2011). This research differs from research of Dewa et al (2012) on the quality analysis of refill drinking water in South Kuta subdistrict, Bandung regency, where the result of its physical quality has not fulfilled the health requirement of Minister of Health Regulation No. 492 / MENKES / PER / IV / 2010 regarding requirements drinking water.

Water Quality Inspection of Drinking Water Refills

The results of the examination at the Laboratory Terpadu Poltekkes Kemenkes Bengkulu, based on table 3 note that the quality of DAMIU chemistry in the work area of West Lingkar Puskesmas Bengkulu City, from 9 samples examined entirely 100% meet health requirements according to Minister of Health Regulation No. 492 / MENKES / PER / IV / 2010. This research tidah same with research of Dewa et al (2012) about quality analysis of drinking water refill in sub district of Kuta Selatan, Regency of Bandung, Bali where the result of chemical quality not yet fulfill health condition Minister of Health Regulation Number 492 / MENKES / PER / IV / 2010 about drinking water requirements.

Drinking water must be in accordance with the requirements according to the Minister of Health Regulation No.492 / MENKES / PER / IV / 2010, the coliform bacteria and Escherichia Coli that are allowed are 0 in 100 ml of water. Coliform bacteria is a group of intestinal bacteria, which live in the human digestive tract. Coliform bacteria is an indicator of the presence of pathogenic bacteria and belongs to the class of microorganisms commonly used as an indicator, where these bacteria can be a signal to determine whether a water source has been contaminated by pathogens or not. This coliform bacteria produces ethionine which can cause cancer.

In addition this decomposing bacteria also produces various poisons such as indol and skatol which can cause disease if the amount is excessive in the body while Escherichia coli bacteria are the indicator bodies in the water substrate and food ingredients that are capable of fermenting lactose at 370C. Escherichia coli is present in high amounts in human faeces. The temperature of the water in which nutrient levels in the drinking water distribution system are likely to support the growth of this organism. The presence of Escherichia coli provides evidence of fases contamination (Widyastuti, 2014). This research is similar to the research of Rido et al (2012). The results of the quality inspection of drinking water produced by refill drinking water depots in Bungus Padang Subdistrict do not meet the requirements for use in microbiological parameters.

V. CONCLUSION

Based on the results of the study and discussion of qualitative and quantitative analysis of physical, chemical and microbiological examination of DAMIU in the working area of the Bengkulu City West Rim Health Center, it can be concluded that more than 7 (58.67%) DAMIU meet sanitation hygiene requirements, the results of examination of refill drinking water those in DAMIU physically and chemically 100% meet the health requirements of drinking water, and more than half (66.67%) of refill drinking water in DAMIU in the working area of the West Rim Health Center in Bengkulu City are microbiologically eligible for consumption. Suggestions can be taken into consideration for local governments and health centers to monitor the quality of refill drinking water that is increasingly circulating in the community to ensure quality and safety quality.

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