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DETERMINATION OF MICROBIOLOGICAL QUALITY OF TAP WATER IN FOOD PRODUCTION AND INVESTIGATION ON THE PUBLIC HEALTH PROTECTION

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ABSTRACT

Water is one of the indispensable and vital elements of living life. It was aimed to investigate the microbial pollution of the tap water that taken from the food enterprises producing. In total, 100 unit of water samples that taken from the food enterprises in the Aegean Region were used as material. Microbiological analyzes of water samples were determined according to the parameters in Annex-2/A "Regulation on Waters for Human Consumption". *E. coli* between 1-103 cfu/100mL and coliform group between 1-110 cfu/100mL were detected in 10% and 16.25% of 80 samples of drinking-tap water, *C. perfringens* (including spores) were not detected in any of the samples. *E. coli* between 10-62 cfu/100mL, coliform group bacteria between 10-89 cfu/100mL and couting colony at 22 and 37°C between 16-145 cfu/100mL were detected in 20%, 50% and 35% of 20 samples of spring water, *C. perfringens* (including spores) and *P. aeruginosa* were not detected in any of the samples. Coliform group microorganisms and *E. coli* that indicator microorganisms of fecal pollution have detected are above the legal limit in some water in our work. This situation constitutes a risk ethic in terms of public health. That's why, all hygiene controls must also be thoroughly performed in terms of public health.

Keywords: Drinking-tap water, Hygiene, Microbiological, Public health

INTRODUCTION

Water is one of the indispensable and vital elements of living life. As a result, there is a close relationship between water quality and health. Many diseases (such as *Salmonella typhimurium*, *Escherichia coli*, *Aeromonas hydrophyla*, *Shigella* spp.) can affect people and can cause important health problems with non-hygienic water. (1,2). Although there is an assumption that drinking and tap water can be different from each other, drinking and tap water are the same. Indeed, tap water is used in cleaning, dishwashing, cooking, kitchen, production and business (3).

Especially, the tap water which is constantly used in the food production centers comes into direct contact with the foodstuffs directly or indirectly (personnel, equipment, etc.) and the foodstuffs produced in this way are consumed continuously by people.

For this reason, drinking-tap water that must have the microbiological, physical and chemical qualities are determined by statutes and standards in many countries. The properties that to be searched in drinking-tap waters were listed with the "Regulation on Water for Human Consumption" published by the Ministry of Health, in our country, in 2005. (4).

In this study, it is aimed to investigate the microbial pollution of the tap water that taken in sterile conditions from the food enterprises producing in different fields and to determine the factors that could create a risk on public health.

MATERIALS AND METHODS

Materials

In total, 100 units of water samples including 80 drinking-tap water, 20 spring water samples taken at different periodical times throughout the year were used as food material and microbiological pollution conditions of them were investigated in the Aegean Region in 2016.

Methods

Samples that taken in sterile conditions, as reported in TS 266 (5), in sterile thiosulfate water sample bottles (Merck-L291648) and brought to the laboratory in cold chain were analyzed on the same day. Samples were stored at +4° C until the results of the analyzes.

Microbiological analyzes of water samples were determined according to the parameters in Annex-2/A (4) "Regulation on Water for Human Consumption". According to this, *E. coli*, coliform bacteria and *Clostridium perfringens* (including spores) were analyzed in drinking-tap waters, *E. coli*, coliform bacteria, *Clostridium perfringens* (including spores), *Pseudomonas aeruginosa*, colony counting at 22 and 37° C were analyzes in source waters.

E. coli and coliform bacteria that passing 100 mL of water through 0.45 µm pore diameter membrane (Merck-A931645) with membrane filtration system according to method of TS EN ISO 9308-1 (6) were grown at 36±2° C for 21±3 hours in a chromogenic Chromocult Coliform Agar (Merck-110426), *C. perfringens* that passing 50 mL of water through 0.22 µm pore diameter membrane (Merck-A931022) with membrane filtration system according to method of 98/83 EC Directive (7) were grown at 44±1° C for 21±3 hours in anaerobic conditions in a m-CP Agar (Liofilchem-163612), *P. aeruginosa* that passing 100 mL of water through 0.45 µm pore diameter membrane (Merck-A931645) with membrane filtration system according to method of TS EN ISO 16266 (8) were grown at 36±2° C for 44±4 hours in a *Pseudomonas* CN Agar (Liofilchem-163592), colony counting at 22 and 37° C that passing 100 mL of water through 0.45 µm pore diameter membrane (Merck-A931645) with membrane filtration system according to method of TS EN ISO 6222 (9) were grown at 22±1° C for 68±4 and 36±1° C for 44±4 hours in a Yeast Extract Agar (Liofilchem-611016).

RESULTS

Microbiological analysis results of drinking-tap and spring water are shown after incubation periods in Tables 1 and 2.

Table 1. Microbiological analysis results of drinking-usage water samples

Analyses	Total Sample Number	Positive Sample Number	Negative Sample Number	Least (cfu)	Most (cfu)
E. coli (cfu/100mL)	80	8	72	1	103
Koliform bakteri (cfu/100mL)	80	3	83	1	110
C. perfringens (cfu/50mL)	80	-	80	-	-

Table 2. Microbiological analysis results of spring water samples

Analyses	Total Sample Number	Positive Sample Number	Negative Sample Number	Least (cfu)	Most (cfu)
E. coli (cfu/100mL)	20	4	16	10	62
Koliform bakteri (cfu/100mL)	20	10	10	10	89
C. perfringens (cfu/50mL)	20	-	20	-	-
P. aeurigosa (cfu/100mL)	20	-	20	-	-
Couting colony at 22°C (cfu/100mL)	20	7	13	21	145
Couting colony at 37° C (cfu/100mL)	20	7	13	16	120

In our study, *E. coli* between 1-103 cfu/100mL and coliform group between 1-110 cfu/100mL were detected in 10% and 16.25% of 80 samples of drinking-tap water, *C. perfringens* (including spores) were not detected in any of samples. *E. coli* between 10-62 cfu/100mL, coliform group bacteria between 10-89 cfu/100ml and couting colony at 22 and 37°C between 16-145 cfu/100mL were detected in 20%, 50% and 35% of 20 samples of spring water *C. perfringens* (including spores) and *P. aeruginosa* were not detected in any of the samples.

Detection of *E. coli* and coliform bacteria group in tap and spring waters shows the presence of fecal contamination in the tap and spring water. Although not very harmful, the presence of fecal contamination in the water indicates natural pathways or direct contamination of the water with faeces.

Microbiological limit values of various water types were given in Annex-1 of the Ministry of Health's "Regulation on Water for Human Consumption" (Tables 3 and 4).

Table 3. Microbiological parameters and limit values for drinking-usage water (4)

Parameters	Parametric value
E. coli	0/100mL
Koliform bakteri	0/100mL
C. perfringens	0/50mL

Table 4. Microbiological parameters and limit values for spring water (4)

Parameters	Parametric value
E. coli	0/100mL
Coliform bacteria	0/100mL
C. perfringens	0/50mL
P. aeurigosa	0/100mL
Couting colony at 22° C	20/100mL
Couting colony at 37° C	5/100mL

DISCUSSION

The physical, chemical and microbiological quality criteria have been established for drinking and tap water in many countries. Microbiological parameters are the most important criteria to be considered in terms of public health in the water. Because the water cycle plays an important role in the transmission of enteric diseases. Alişarlı et al. found that 20% of the 360 drinking and tap water in the Van Region in 2007 was not suitable for regulation in terms of microorganism of coliform group (10). In addition, Demirtaş and Aydın found coliform group microorganisms in 43.3% of the 180 water samples in their study on the usage water of the chicken companies in Kayseri in 2001 (11). For this reason, the quality of the water which used in food production must be checked frequently from the microbiological direction. The frequency of sampling and analysis is determined according to the usage amounts (m^3) of the drinking-usage water used by the enterprises in Annex-2/B (4) of the "Regulation on Water for Human Consumption" published by the Ministry on this subject. Routine controls of the analyzes are carried out continuously according to these parameters.

CONCLUSIONS

Coliform group microorganisms and *E. coli* that indicator microorganisms of fecal pollution have detected are above the legal limit in some water in our work. This situation constitutes a risk ethic in terms of public health. However, businesses can reduce and remove these risk factors in terms of public health with joint common sense studies with the ministry. For this purpose, routine analysis and controls of these microorganisms, which constitute risk workers in the tap water should be continuously monitored and the factors causing this contamination should be determined and necessary precautions should be taken. In addition, all hygiene controls must also be thoroughly performed in terms of public health.

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