**Public Schools of Uberaba, Minas Gerais, Brazil**

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**ABSTRACT**

This study had the objective of evaluating the quality of water consumed by schoolchildren in the city of Uberaba, taking into account the results of chemical analyzes to determine the levels of free residual chlorine levels of chromium, copper, manganese, lead and cadmium, in addition to microbiological analysis to determine total coliforms and Escherichia coli, taking as parameter for drinking water, the values established by Ordinance n0. 2914 of 2011 of the Ministry of Health. Water samples from drinking fountains and kitchen faucets from eight institutions of child education in public schools that serve children with age 0-5 years were analyzed. Sampling was conducted on a quarterly periods from December 2011 to September 2012, resulting in four collections. The results revealed the presence of Escherichia coli and total coliforms above the permissible values by legislation, by more than 50% of samples. It was also observed, concentration of free residual chlorine below the minimum value required by law in nearly half of the samples analyzed. In relation to the concentration of metals, some samples had water contents of copper, cadmium, chromium, manganese and lead above the permissible. Statistical tests revealed that when analyzing the period of realization of sampling, only the values for the concentration of free residual chlorine, chromium and lead showed no significant difference (p> 0.05). The results show the need for corrective actions at the point of supply of water for the school population, in addition to monitoring and controlling the quality of water for human consumption.

**Keywords:** Drinking water; Chemical analysis; Microbiological analyzes.

**Análise Química e Microbiológica da Água de Escolas Públicas Municipais de Uberaba- MG**

**RESUMO**

Este estudo apresentou como objetivo a avaliação da qualidade da água consumida por escolares na cidade de Uberaba- MG, levando-se em consideração os resultados das análises químicas para determinação dos teores de cloro residual livre e níveis de cromo, cobre, manganês, chumbo e cádmio, além das análises microbiológicas para determinação de coliformes totais e *Escherichia coli*, tomando-se como parâmetro para água potável, os valores estabelecidos pela Portaria nº 2.914 de 2011 do Ministério da Saúde (Brasil, 2011). Foram analisadas amostras de água provenientes de bebedouros e torneiras da cozinha de oito instituições de ensino infantil da rede pública municipal que atendem crianças com a faixa etária de 0 - 5 anos. As amostragens foram realizadas em períodos trimestrais compreendidos entre dezembro de 2011 a setembro de 2012, resultando em quatro coletas. Os resultados obtidos revelaram a presença de *Escherichia coli* e coliformes totais, acima dos valores permissíveis pela legislação, em mais de 50% das amostras analisadas. Foi verificado ainda, teor de cloro residual livre abaixo do valor mínimo exigido pela legislação vigente em quase metade das amostras analisadas. No que se refere à concentração de metais, algumas amostras de água apresentaram teores de cobre, cádmio, cromo, manganês e chumbo acima do permitido. Os testes estatísticos revelaram que, quando analisado o período de realização das amostragens, apenas os valores referentes à concentração de cloro residual livre, cromo e chumbo não apresentaram diferença significativa (p>0,05). Os resultados obtidos revelam a necessidade de ações corretivas nos pontos de fornecimento de água para a população escolar, além do monitoramento e controle da qualidade da água para consumo humano, tanto pelos gestores escolares como pelas autoridades sanitárias.

**Palavras-chave:** Água potável; Análises químicas; Análises microbiológicas.

**1. INTRODUCTION**

Drinking water is vital to the survival of all living organisms and the functioning of cosystems, communities and economies. However, in the last decade, water quality worldwide is being threatened due to population increases, agricultural and industrial activities (Khan et al., 2013; Baird, 2002). These changes resulted in climate change, directly affecting the global hydrological cycle .

It is known that the supply of good quality water, adequate, reliable and affordable to the population is closely linked to human health. However, according to the Environmental Company of São Paulo (2008), part of the available fresh water on the planet is in some stage of contamination (Cetesb, 2008).

According to the World Health Organization - WHO, at present, 1.2 billion people do not have drinking water, 80% of diseases and 30% of deaths worldwide are caused by contaminated water (Hênio, 2012). Already, as a result of poor water quality, the study by the UN shows that at least 1.8 billion children under five years old die (Giraldi, 2010).

In several educational institutions, has become an increasingly common, index waterborne diseases in addition to physical changes related to its odor, color and taste. These facts may be related to contamination in water tanks or infiltration in pipes. So it becomes important monitoring and further analysis of the quality of waters originating from both storage boxes such as faucets and drinking fountains for consumption of the school community.

**2. MATERIAL AND METHODS**

**2.1. Collection of Water Samples for Chemical Analysis**

Initially, the collection site (faucet or drinking fountain) was held open, permitting the outflow of water for at least three minutes. Polypropylene Polypropylene bottles Polypropylene bottles Polypropylene bottles were used previously, for acclimating local water, in order to minimize possible interference to the collection and storage of water samples on chemical analyzes**.**

**2.2. Collection of Water for Microbiological Analyzes**

The collection site was sanitized with 70% ethanol and then flamed to avoid interference in the results due to external contamination. Then, the water samples used for microbiological analyzes were collected from drinking fountains and kitchen faucets of child educational institutions, in amber bottle, previously autoclaved, containing 0.1 mL of sodium thiosulfate to 10% for every 100 mL of water collected.

**2.3. Analysis of Free Residual Chlorine**

The determination of free residual chlorine was taken by the direct method using a hand photometer checker chlorine-free, range from 0.00 to 2.50 mg L-1 - Model HI 701 at the collection site.

**2.4. Metals Analysis**

The samples passed through the digestion process by the procedure of Method 3005A, Environmental Protection Agency for the analysis of metals (Usepa, 1992; Nikaido et al., 2010). 50 mL aliquots of a water sample tubes were added into the digester block to which was added 2 mL of HNO3 and 5 mL of HCl. Then, the temperature was raised to 110ºC and maintained until the sample volume was reduced to 15 mL under reflux. After cooling, the samples were transferred to a 50 mL volumetric flask, then supplementing the volume with Milli-Q water. The sample was filtered and kept at 4 0 C, until further analysis.

Analyses of Pb, Mn, Cr, Cu and Cd metals were performed at the Institute of Chemistry of São Carlos - IQSC / USP from São Carlos, in an inductively coupled plasma spectrometer (ICP-OES).

**2.5. Analysis of Bacteria**

Laboratory analysis of water samples collected for the assessment of total and thermotolerant coliforms were made by the Technical Membrane Filtering in accordance with the procedures of "Standard Methods for the Examination of Water and Wastewater'' and of the Company of Environmental Sanitation Technology (APHA, 2005; Cetesb, 2006).

Samples were filtered through a suitable membrane filter and sterile with porosity (porosity 0.45 µm and 47 mm in diameter). The filtration was performed on a device contained in a filter funnel with lid, membrane and receiver flask.

**2.6. Analysis of Results**

As a reference guide for analysis of the results we used the 2914 Ordinance of the Ministry of Health which establishes the procedures and responsibilities relating to the control and supervision of water quality for human consumption and its potability standards and other provisions (Brasil. 2011).

**2.7. Statistics**

For statistical analysis of the final results, the resulting values for all analyzes were copied into a database in Microsoft Excel 2003 version program and transferred to the software ASSISTAT 7.6-beta version 2008 for testing normality and homogeneity of data. The results obtained for each of the variables analyzed showed no homogeneity among themselves checked when the period to measurements, so these values were subjected to non-parametric Kruskal-Wallis test (ANOVA), ASSISTAT software - 7.6-beta version in 2008 with level significance of p> 0.05.

**3. RESULTS AND DISCUSSION**

**3.1. Free Residual Chlorine**

The values of free residual chlorine obtained in the analysis of water sampled in the fountain of the eight institutions of child education, in the four stages of data collection, showed in the range of 0.00 to 1.04 mg L-1, while levels of free residual chlorine concerning water samples from faucets of eight institutions of child education, ranged from 0.00 to 1.00 mg L-1, as showed in Table 1.

**Table 1.** Values of free residual chlorine obtained from the analyzes of water samples used for intake of schoolchildren, in eight institutions of child education in Uberaba, Minas Gerais.

|  |  |  |
| --- | --- | --- |
| **Educational Institutions** | **Sampling sites** | **Apparent color (uH)** |
| **1 st collection****(12/14/11)** | **2 nd collection (03/19/12)** | **3 rd collection (06/25/12)** | **4 th collection****(09/26/12)** |
| A | Fountain | 0.80 | 0.08 | 0.83 | 0.00 |
| Faucet | 0.09 | 0.10 | 0.14 | 0.00 |
| B | Fountain | 0.30 | 0.60 | 0.73 | 0.30 |
| Faucet | 0.09 | 0.60 | 0.84 | 0.00 |
| C | Fountain | 1.00 | 0.70 | 1.04 | 0.30 |
| Faucet | 0.80 | 0.70 | 0.96 | 0.30 |
| D | Fountain | 0.10 | 0.04 | 0.14 | 0.00 |
| Faucet | 0.09 | 0.14 | 0.38 | 0.00 |
| E | Fountain | 0.80 | 0.52 | 0.54 | 0.10 |
| Faucet | 0.80 | 0.61 | 0.84 | 0.10 |
| F | Fountain | 0.10 | 0.16 | 0.14 | 0.00 |
| Faucet | 1.00 | 0.64 | 0.65 | 0.10 |
| G | Fountain | 1.00 | 0.51 | 0.84 | 0.30 |
| Faucet | 1.00 | 0.63 | 0.11 | 0.30 |
| H | Fountain | 0.22 | 0.05 | 0.30 | 0.30 |
| Faucet | 0.16 | 0.07 | 0.37 | 0.05 |

The results obtained in this study revealed that samples of water collected in water fountains and kitchen faucets, 100% of them responded to the maximum required by Ordinance no. 2914 of 2011 of the Ministry of Health, 2.0 mg L-1, for free residual chlorine variable (Brasil, 2011). Now, with reference to the minimum value of 0.2 mg L-1, determined by law, regarding the concentration of free residual chlorine, 40.62% of the samples from the kitchen taps and 31.25% of samples from water fountains did not attend the recommended standard.

Also, in relation to the concentration of free residual chlorine, no significant difference (p> 0.05) between sampling periods conducted in water fountains and kitchen faucets from the eight educational institutions selected for the study was found, and therefore, expendable statistical analysis for this variable.

**3.2. Metals**

Among the various chemical contaminants, the study of heavy metals has been considered a priority in health promotion programs worldwide (Nikaido et al., 2010). According to Baird (2002), the term heavy metal refers to a class of chemical elements; many of them are harmful to humans.

Humans can be exposed to metals from several sources, and water is a main pathway of contamination, so maybe it is a growing concern about the good quality water from the spring to the point of consumption (Chakrabarty e Sarma, 2010).

For this research were examined the levels of lead (Pb), manganese (Mn), chromium (Cr), copper (Cu) and cadmium (Cd) present in the water samples analyzed. The results revealed the copper concentration above those permitted by legislation in 3.125% of the samples analyzed. And compared to the levels of cadmium, 51.56% of the samples presented themselves at odds with recommendations by the Ministry of Health. It has further been found that 12.5%, 7.82% and 45.31% of samples did not attend the recommended by Ordinance 2914 / MS for concentrations of Mn, Pb and Cr, respectively (Brasil, 2011).

The average rating of Mn present in the water samples from drinking fountains and kitchen faucets from educational institutions selected for research over the four collection periods beyond the maximum allowable value (MAV) of 0.1 mg L-1 for drinking water, are shown in Fig. (1).



**Figure. 1.** Variation of Mn concentrations in water samples from drinking fountains and kitchen faucets from eight institutions of child education throughout the four collections undertaken from December 2011 to September 2012.

It was found that, in relation to samples of water from the drinking fountains and kitchen faucets from the eight institutions of child education selected for the survey, the values for concentration of manganese metal referring to the first collection differed statistically from other collections, showing also higher average value thereto. Now, the third and fourth collections undertaken did not differ significantly from each other, differing, however, the first and the second, presenting still less than those mentioned before, in the concentration of Mn average.In relation to the variation of the concentration of Cu present in water samples from drinking fountains and kitchen faucets from the eight educational institutions selected for the survey, it was observed that, when analyzing water samples from drinking fountains, they showed no significant difference among themselves as to the sampling period. However, when analyzing water samples from the taps in the kitchen, it was observed that they differ among them (p <0.05) when analyzing the variation of copper concentration.

Figure 2 shows the medium values of the concentration of Cu present in water samples from kitchen taps from the eight institutions of child education selected for the research, beyond the maximum allowed value (2 mg L-1,) established by the current legislation for drinking water.



**Figure.** **2.** Variation of Cu concentration in water samples from faucets from eight institutions of child education during the four collections undertaken.

When analyzing the average variation in Cd concentration in water samples from drinking fountains and kitchen faucets from the eight educational institutions selected for this study, there was a significant variation in the concentration of the metal cited before, during the four collections undertaken for the two collection points mentioned. For the water samples from drinking fountains from the eight institutions of child education selected for study, it was also observed that the fourth collection showed a mean value higher than the other samples, while the first collection presented lower mean concentration of Cd.

When analyzing the water samples coming from the kitchen faucets of infant education institutions selected for the survey, it was observed that the third sample showed a significant difference from the other samples, when analyzing the variation of Cd concentration, even with average superior value to other collections undertaken. On the other hand, the first and the second collections undertaken, did not differ significantly from each other, differing, however from the other collections, besides presenting lower average concentration of Cd, compared to the others.

Figure 3 shows the values of the variations of Cd concentration in water samples from drinking fountains and kitchen faucets, from the eight institutions of child education selected for the research along the four collections undertaken beyond the default value of 0.005 mg L-1, established as recommended by the Ministry of Health for drinking water.



**Figure 3.** Variation of Cd concentration in water samples from drinking fountains and kitchen faucets from eight institutions of child education along the four collections undertaken.

The concentrations of Pb and Cr in water samples from drinking fountains and taps, showed no significant difference when analyzing the different sampling periods, it is not necessary therefore, the application of statistical tests for these results.

**3.3. Coliforms**

The presence of coliforms in water indicates contamination, leading to a potential risk of the presence of pathogenic organisms. Its absence is evidence of a bacteriologically safe drinking water, since coliforms are more resistant in water than the pathogenic bacteria of intestinal origin (Oliveira et al., 2012).

Siqueira et al. (2010) reported that, although there is no limitation to the number of coliforms in drinking water, Ordinance n0. 518 of the Ministry Health of 2004, it suggests that, when verifying the presence of total coliforms and absence of fecal coliforms, it's necessary to be taken immediate corrective action and preventive character, such as cleaning water tanks and cisterns. The Ordinance of the Ministry of Health n0. 2914 of 2011 considers the maximum value allowed - VMP-Escherichia coli and total coliforms in water for human consumption in systems that analyze 40 or more samples per month, the absence in 100 mL 95% of the samples examined in the month. On systems that analyze less than 40 samples per month, only one sample can submit a monthly positive result in 100 mL (Brasil, 2011).

**3.4. Total Coliforms**

The values of total coliforms obtained from the analyzes of water samples collected in the drinking fountains of the eight institutions of child education, selected for the research presented in the range of 0 to 57 MPN/100 mL, while the values of total coliforms for samples coming from the kitchen faucets found in the range of 0 to 68 MPN / 100 mL, as shown in Table 2.

**Table 2** Results of analyzes of water samples from drinking fountains and kitchen faucets from eight institutions of child education selected to research for the presence of total coliforms.

|  |  |  |
| --- | --- | --- |
| **Educational institutions** | **Sampling sites** | **Total Coliforms (\*MPN/100mL)** |
| **1st sampling****(12/14/11)** | **2nd sampling****(03/19/12)** | **3 rd sampling****(06/25/12)** | **4th sampling****(09/26/12)** |
| **A** | Fountain | 22 | 1 | 2 | 2 |
| Faucet | 14 | 1 | 3 | 4 |
| **B** | Fountain | 4 | 1 | 3 | 1 |
| Faucet | 0 | 0 | 4 | 0 |
| **C** | Fountain | 4 | 0 | 0 | 0 |
| Faucet | 1 | 1 | 5 | 0 |
| **D** | Fountain | 10 | 8 | 36 | 0 |
| Faucet | 1 | 2 | 23 | 0 |
| **E** | Fountain | 57 | 27 | 5 | 1 |
| Faucet | 0 | 24 | 10 | 0 |
| **F** | Fountain | 54 | 1 | 4 | 0 |
| Faucet | 15 | 1 | 3 | 0 |
| **G** | Fountain | 3 | 2 | 10 | 0 |
| Faucet | 2 | 0 | 8 | 68 |
| **H** | Fountain | 0 | 0 | 13 | 0 |
| Faucet | 0 | 0 | 42 | 1 |

\* MPN/100mL most probable number in 100 mL.

 According to the values presented in Table 2, it was observed that, from the 32 samples (100%) of water derived from drinking fountains, 23 (71.875%) did not attend the standard established by Ordinance No. 2914 of the Ministry of Health, 2011. Now, for the 32 water samples collected in the kitchen faucets, 65.625% (21 samples) did not comply with legislation, with values above those established by current legislation for drinking water.

 It was observed that the water samples taken from the four collections undertaken showed significant differences (p <0.05) among themselves when analyzing the presence of total coliforms. It was also observed that, for the samples of water derived from drinking fountains in the fourth session held, they had lower average value for the others collections.

 Also, in relation to water samples from the drinking fountains, the first collection presented higher average value for the presence of total coliforms, differing from the others collections undertaken. Now, the water samples related to the third collection held, differed significantly from the others collections undertaken, showing higher average only compared to the second collection value when analyzing the presence of total coliforms. When analyzing samples of water derived from the faucets in the kitchen, it was found that all samples differ among them, in the sampling period. It was observed that the samples related to the third collection showed average of total coliforms, higher than the results obtained for the other collections undertaken. Now, the samples resulting from the second sample, showed an average lower than all the collections undertaken. The first sample also differ from the others collections in relation to the most probable number of coliforms presenting a higher average value, only in relation to the second collection held. It was also found that, for the water samples coming from the fourth session held, they had lower average value only compared to the third collection held.

 Figure 4 is illustrated the variation in the number of total coliforms present in the water samples from drinking fountains and kitchen faucets in child education institutions selected for the survey in the four collection periods.



**Figure 4.**  Variation of total coliforms in samples of water from drinking fountains and kitchen faucets from eight institutions of child education throughout the four collections

**3.5. Escherichia coli**

 Ordinance no. 2914 of the Ministry of Health, 2011, establishes as potability standards for water intended for human consumption, the absence of bacteria of the thermotolerant coliforms group, formerly fecal coliforms. The waterborne diseases are transmitted through ingestion of water contaminated with pathogenic micro-organisms eliminated in the feces of humans and / or animals. One can safely say that waterborne diseases are one of the most serious threats to the child population. This group of diseases is among the five leading causes of death in individuals between one to four years-old. (German e German, 2001).

The results of the analyzes of water samples from drinking fountains and faucets in child education institutions selected for the research were presented in Table 3.

**Table 3** Results of analyzes of water samples from drinking fountains and faucets of eight institutions of child education selected for the survey, in relation to the number of Escherichia coli.

|  |  |  |
| --- | --- | --- |
| **Educational institutions** | **Sampling sites** | **Escherichia coli (NMP/100mL \*)** |
| **1st collection****(12/14/11)** | **2nd collection (03/19/12)** | **3rd collection****(06/25/12)** | **4th collection****(09/26/12)** |
| **A** | Fountain | 20 | 1 | 2 | 4 |
| Faucet | 14 | 1 | 2 | 4 |
| **B** | Fountain | 2 | 1 | 3 | 1 |
| Faucet | 1 | 0 | 5 | 0 |
| **C** | Fountain | 0 | 0 | 0 | 0 |
| Faucet | 0 | 1 | 4 | 0 |
| **D** | Fountain | 9 | 3 | 14 | 1 |
| Faucet | 0 | 2 | 0 | 3 |
| **E** | Fountain | 3 | 11 | 3 | 1 |
| Faucet | 2 | 25 | 0 | 0 |
| **F** | Fountain | 6 | 1 | 4 | 0 |
| Faucet | 74 | 1 | 3 | 0 |
| **G** | Fountain | 10 | 0 | 0 | 0 |
| Faucet | 0 | 0 | 0 | 68 |
| **H** | Fountain | 1 | 0 | 3 | 0 |
| Faucet | 0 | 0 | 7 | 1 |

 \* MPN/100mL most probable number in 100 mL.

According to Table 3, it was observed that the thirty-two water samples (100%) from the drinkers, 22 (68.750%) did not attend with that recommended by the Ordinance n0 2914 of 2011 of the Ministry of Health for drinking water. In relation to the thirty-two samples of water from the faucets, 18 (56.250%) did not attend the parameters established by the current law.The Kruskal-Wallis test, a 5% significance level was performed with the objective of identifying the existence of a significant difference in relation to the presence of Escherichia coli in different sampling periods of the water.Water samples from the kitchen faucets, showed no significant difference when analyzing the presence of E. coli in different sampling periods.

 It was found that the water samples collected in drinking fountains of child education institutions selected for study, differ significantly for the presence of Escherichia coli when analyzing the collection period held.

 It was also observed that the water samples referring to the first collection performed significantly, differing from the other samples taken and showed higher average value of the most probable number of E. coli when compared with values obtained from other collections made. The water samples, referring to the fourth session held, showed significant differences in relation to the other collections, showing also lower average value to these, when analyzing the presence of E. coli.

 The second collection differed significantly from the other collections done, showing higher average value than the fourth collection and lower than all the other collections in relation to the most probable number of fecal coliforms in 100 mL of water sample analyzed. Regarding to the third collection, it showed significant difference (p <0.05) compared to the other samples, when analyzing the presence of coliforms of the genre Escherichia coli in water samples, showing higher average value only in relation to the fourth session held. Figure 5 shows the results of the variation in the number of thermotolerant coliforms in water samples collected in drinking fountains of the institutions of child education in different sampling periods.



**Figure. 5.** Variation of thermotolerant coliforms present in water samples from drinking fountains of eight institutions of child education selected for research during the four collections held.

**4. CONCLUSION**

The water which comes to the reservoir of public schools is used, among other purposes, for cleaning, personal hygiene and for feeding. To ensure the maintenance of quality and sanity of the water used in educational institutions, it is necessary that it be stored in clean containers and disinfected at least twice a year.

In several educational institutions, it has become increasingly common the index of waterborne diseases , in addition to physical changes related to its odor, color and taste. These facts may be related to contamination in water tanks or infiltration in pipes. For this reason, it becomes important monitoring and further analysis of the quality of waters originating from both storage boxes such as faucets and drinking fountains for consumption of the school community.

The results of this study show that in relation to the concentration of free residual chlorine, all the samples were below the maximum value allowed by law (2.0 mg L-1). However, 40.625% of water samples did not attend the minimum required value of 0.2 mg L-1,. The most aggravating results were found at School A, where all the collected samples did not meet the minimum values recommended by Ordinance 2914, 2011, Ministry of Health.

When analyzing metal concentration, 68.75% of water samples referring to the first collection (12/14/2011) showed level of chromium above those permitted by Ordinance n0. 2914 of the Ministry of Health, 2011. Now, for samples related to the second collection (03/19/12), 50% of them showed concentration of chromium and manganese above the permissible and 25% had lead content, above recommended for drinking water. Regarding to the results for the third collection held (06/25/12), 31.25% of the water samples analyzed were out of the established standard for chromium concentration, being more worrying factor in relation to Cadmium, which all samples had values above recommended by the Ministry of Health, in which all samples showed values above recommended by the Ministry of Health. For water samples concerning the fourth sampling (09/26/12), 50% did not attend the permitted standard concentration of Cr and all samples were above the maximum value allowed for concentration of Cd.

Adding to the information submitted, all water samples originating from institution C, presented themselves at odds with the current legislation, regarding the maximum concentration of chromium required for drinking water.

For the microbiological quality of water used by the school community in child education institutions investigated, it was observed, the presence of total coliforms in 68.75% of the water samples analyzed, although all samples of water from the drinking fountains and faucets in the school A, showed unacceptable levels of total coliforms, not attending that recommended by the Ministry of Health.

Another important fact was observed in relation to the variation of the most probable number of total coliforms in samples analyzed during the four collections done: the samples coming from the first sampling, 75% of them showed the presence of total coliforms. This value was modified to 93.75% in the second collection, decreasing to 68.75% in the third collection, and reaching 37.5% in the fourth session held. This decrease in the value of the number of total coliforms, can be justified by the fact that the fourth session was held on the date of 09/26/2012, after the period of cleaning the water reservoirs, which took place in a school recess period (July/2012).

For the presence of Escherichia coli, 65.625% of the samples were in disagreement with the recommendations of the legislation for drinking water. In the first collection (12/14/11) and the third collection (06/25/12) the presence of E. coli, were identified in 68.75% of the water samples analyzed. The value increased to 75% in the second collection, reducing to 50% in the fourth session held.

Still related to the presence of thermotolerant coliforms, it is important to emphasize the damage of all water samples coming from the School A. This fact can be explained by the reason of these samples present values of free residual chlorine, below the minimum value required by law.

This study was conducted on children's educational institutions, whose commitment is to provide, in addition to educational training, security for the students through an appropriate infrastructure, with proper cleaning, hygiene and nutrition.

The evaluation of water quality should be an integrated manner, considering all the information of physical, chemical and microbiological character. The different parameters presented here are assessment tools that can be grouped to contemplate the most relevant characteristics of the quality of the public water supply. In general, these studies show the need to maintain a system of monitoring and controlling for the appropriate quality surveillance of water intended for school.

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