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# PHYSICAL-CHEMICAL AND MICROBIOLOGICAL ANALYSIS OF RAINWATER USED FOR CONSUMPTION OF STORED IN RESERVOIRS THE RURAL AREA IN THE MUNICIPALITY OF CONDEÚBA

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**ABSTRACT**

This work presents results obtained from the determination of physicochemical and microbiological parameters.stormwater used for human consumption. Eight rainwater samples were collected from reservoirs located in rural areas of the city of Condeúba located in the southwestern region of the state of Bahia. The objective of this work was to evaluate and compare the results obtained by the analysis with the maximum values allowed according to the Consolidation Ordinance No. 5/2017 Annex XX of the Ministry of Health, which deals with the quality of drinking water and its standard. of potability. The results obtained from the pH analysis ranged from 4.38 to 8.07 with an average of 6.49; hardness ranged from 26.8 mg / L to 106.4 mg / L, with an average of 48.1 mg / L; electrical conductivity ranged from 10.8 to 146.9 µS / cm, with an average of 79.96 µS / cm; turbidity ranged from 0.35 to 8.18 UNT, with an average of 1.70 UNT; alkalinity ranged from 13.4 mg / L $CaCO_3$ to 61.4 mg / L $CaCO_3$ with an average / total alkalinity of 39.8 mg / L $CaCO_3$; resistivity ranged from 8.8K Ωm to 22.6K Ωm with an average of 12.82K Ωm; total solids ranged from 5.46 mg / L to 51.8 mg / L with an average of 35.44 mg / L; Regarding the results obtained from the microbiological analysis, in the eight samples evaluated it was possible to observe the presence of total coliforms as well as *Escherichia coli* absent in only one of the samples.



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## INTRODUCTION

The theme water is a subject debated worldwide, approached by different media, social fragments and present in monographs, conferences, legislations, books and component of educational projects. Scholars note that drinking water is being degraded following human action, which has shown the urgency of actions to recover, maintain and preserve water resources (Freitas and Marin, 2015). Water being a universal solvent is essential for many daily tasks, however, it can pose risks to human health when not treated properly. It is very important to monitor water quality continuously, so that waterborne diseases are reduced or even avoided, as well as enjoy the direct and indirect benefits that water offers (Lima; Santos, 2016). About 3 out of 10 people worldwide, or 2.1 billion people, do not have access to safe drinking water (UNICEF; WHO, 2017). According to the Ministry of Health Consolidation Ordinance No. 5 of 03 October 2017, Annex XX, which deals with the Control and Surveillance of Water Quality for Human Consumption and its Potability Standard, drinking water is that which meets the potability standards, ie it conforms to the physical, chemical and microbiological parameters, making it safe for consumption. Man, through the ages has been looking for different ways to alleviate the global challenge of water shortages to meet daily needs. One of the alternatives found by man is the capture of rainwater, which is an economic and sustainable choice (Igbinosa; Osemwengie, 2016). Collecting rainwater from reservoirs, such as through draining from the roof, is a way that could help provide immediate drinking water to households for drinking and other purposes, especially in rural communities, where most of them do not. There are water networks and no other complementary sources (Kwaadsteniet *et al.,* 2013). In addition, the World Health Organization (WHO) identifies rainwater harvesting as an alternative and better source of water along with artesian wells. Water can be obtained from various sources, such as streams, lakes, rivers, ponds, rain, springs and wells. Although these sources exist, clean, contaminant-free and safe water only exists temporarily in nature and is rapidly contaminated by prevailing environmental and natural factors and human action. Because of this, several scientific procedures and tools have been developed to assess water contaminants. Successful handling depends on regular monitoring of the physic-chemical and microbiological quality of water (Sunday *et al.,* 2014). The physical properties of water are related to the aesthetic and specific order of water, with parameters determined as: color, temperature, taste and odor. However, choosing the best-looking water does not certify the same quality. The chemical characteristics of water are associated with dilute substances that modify values in parameters such as acidity, alkalinity, pH, turbidity, total hardness, and are crucial to detect if there are heavy metals in the water (Bortoli, 2016). Although the physicochemical composition of water can affect safety, taste and appearance, bacterial contamination cannot be detected by appearance, taste or smell. Analysis of the microbiological quality of water aims to ensure that the consumer is protected from pathogenic organisms such as bacteria, viruses and protozoa such as total, thermotolerant or fecal coliforms and *Escherichia Coli* (Mulamattathil; Bezuidenhout; Mbewe, 2015). Sampling and analysis of this parametershouldbe done more regularlythan physic-chemicals, as microbial contamination can have acute effects on consumer health (Mulamattathil; Bezuidenhout; Mbewe, 2015). This study aimedto analyze the physicochemicaland microbiological parameters for determining the potability of rainwater stored in reservoirs in rural areas of the municipality of Condeúba, in accordance with Consolidation Ordinance No. 5/2017 Annex XX of the Ministry as Health.

## METHODOLOGY

This was a field and experimental research, with quantitative and qualitative approach. The populations involved in the research were those who live in rural areas of the municipality of Condeúba, which has no access to running water, and use reservoirs as a means to store rainwater. The municipality of Condeúba in the state of Bahia is located in the southwest of the state, the city has a territorial area of 1,348,437 km², with an estimated population in 2018 of 17,319 inhabitants, according to the Brazilian Institute of Geography and Statistics (IBGE). The climate is hot and dry semi-arid, with an average annual temperature between 23°C and 32°C, and the vegetation is caatinga type. The fieldwork was carried out in May 2019, in which rainwater collection for physicochemical and microbiological analyzes was done randomly in the morning in three rural communities of the municipality, Riachão, Mangarito and Mandacaru Eight samples were collected in total, where they were identified as A1, A2 and A3 -Riachão; A4, A5 and A6 - Cuff; A7 and A8 - Mandacaru. Samples for physicochemical analyzes were collected on three separate consecutive days and were placed in 1500 mL sterile containers, while samples for microbiological analysis were collected on the third day of collection, in 1kg sterile plastic bags. These were placed in a thermal box and transported to the laboratory for analysis, and the microbiological analysis was performed within 24 hours of collection. In the laboratory, the procedures described by the Water Analysis Practical Manual were used todetermine thephysicochemical parameters that include the determination of pH, alkalinity, turbidity, conductivity, hardness, resistivity and total solids. The hardness and alkalinity were determined by the titration method, while the conductivity, resistivity, total solids, turbidity and pH by specific devices for each parameter. For microbiological analysis the Enzyme Chromogenic Substrate technique was used Colilert IDEXX, which detects the presence or absence of total coliforms and *Escherichia coli* in 100 mL of each sample, with results within 24 hours. The samples were incubated in the greenhouse at a temperature of 35°C ± 0.5°C for 24 to 28 hours as recommended by the manufacturer.

## RESULTS AND DISCUSSION

### PHYSICAL AND CHEMICAL ANALYSIS

**Hydrogen potential (ph):** pH is classified as one of the most important quality parameters. The pH measurement concerns the acidity or alkalinity of water. A sample is considered acidic if its pH is below 7.0. However, it is alkaline if the pH is higher than 7.0 (Rahmanian *et al.,* 2015). Acid water, for example, can lead to corrosion of the medium in which it is inserted or passing through. Meanwhile, alkaline water signals disinfection. The acidity of rainwater depends on the concentration of anionic and cationic species. Acid pH reveals the presence of strong acids while neutral or alkaline pH indicates neutralization of acids by carbonates, minerals or ammonium. This may be due to the reaction of sulfuric and nitric acid absorbed in the aerosols with alkaline carbonates in the particulate material. Thus, pH becomes a useful tool to measure the acidity of rainwater (Chughtai; Mustafa; Mumtaz, 2014). The results obtained are expressed in Table 1 where we can observe the pH values found in the physicochemical analysis of samples 1, 2, 3, 4, 5, 6, 7 and 8 compared to the limit established in Consolidation Ordinance No. 5 of 2017 Annex XX of the Ministry of Health. Water pH ranged from 4.38 to 8.07 and resulted in an average of 6.49 with an average temperature of 22.15 °C. In this parameter the rainwater samples stored in the reservoirs, according to the general average, are within the established limit, thus characterizing that the samples are suitable for consumption in relation to this parameter. As for samples 1 (pH 4.38) and 7 (pH 5.15) they did not meet the stipulated standard, so they are more aggressive than the others, and may be related to the fact that carbonic acid ($H_2CO_3$) In this water dominate the bicarbonate ($HCO_3^-$) which is a basic element of water balance. Thus it requires a pH correction (Malanda; Matini; Louzolo-Kimbembe; Mbayi and Mabiala, 2019). In a study by Menezes *et al.* (2013) pH values ranged from 6.3 to 6.7, which is consistent with the average found in this study. In the water samples analyzed by Viriato (2011) in Paraíba the pH values ranged from 8.3 to 9.6. Similar values were seen by Almeida (2018) in an analysis made in Caraúbas / RN with a variation of 7.36 to 9.36 with an average of 8.40.

**Table 1. pH of rainwater samples stored in reservoirs in rural Condeúba**

| Sample | pH | Temperature (° C) |
|---|---|---|
| 1 | 4.38 * | 22.6 |
| 2 | 8.07 * | 21.4 |
| 3 | 6.82 | 23.0 |
| 4 | 6.60 | 23.4 |
| 5 | 7.10 | 20.4 |
| 6 | 7.10 | 22.0 |
| 7 | 5.15 | 23.4 |
| 8 | 6.70 | 21.0 |
| Average | 6.49 | 22 , 15 |
| Consolidation Ordinance No. 5/17 Attachment XX of MS - 6.0 to 9.5 | | |

Source: Research data (2019); (*) Variation

**Turbidity:** Turbidity is the cloudiness of water caused by a variety of particles and is another fundamental parameter in the analysis of drinking water. This is measured by the amount of light reflected by the water of a given sample (Rahmanian *et al.,* 2015). High turbidity water has been associated with pathogenic microorganisms. Drinking water legislation recommends that turbidity should not convey any unusual changes, and should be acceptable to consumers. When it comes to water volumes when they are increased and mixed with materials, for example, from the roof, turbidity tends to increase (Igbinosa and Aighewi, 2017). Table 2 depicts the turbidity values found in the physicochemical analysis of samples 1, 2, 3, 4, 5, 6, 7, and 8 compared to the limit set in Ministry of Consolidation Ordinance No. 5, 2017 Annex XX of the Ministry. da Saúde. Water turbidity alternated from 0.35 UT to 8.18 UT and averaged 1.70 UT.

**Table 2. Turbidity of rainwater samples stored in reservoirs in rural Condeúba**

| Sample | Turbidity (UT) |
|---|---|
| 1 | 0.47 |
| 2 | 1.92 |
| 3 | 0.43 |
| 4 | 0.63 |
| 5 | 1.23 |
| 6 | 0.40 |
| 7 | 8.18 * |
| 8 | 0.35 * |
| Average | 1.70 |
| Consolidation Ordinance # 5/17 Attachment XX of MS - 5 UT | |

Source: Research Data (2019); (*) Variation

For this parameter the rainwater samples stored in the reservoirs, according to the general average are within the determined limit, thus representing that the samples are suitable for consumption, linked to this parameter. This factor may be related to the fact that over time the suspended solids in the water were deposited at the bottom of the reservoir used for rainwater storage. However, sample 7 (8.18 UT) did not meet the stipulated standard, which was quite cloudy, in which it was possible to observe the presence of impurities that certainly contributed to the elevation of this parameter, thus making the sample unfit for human consumption. The results obtained by Almeida (2018) when studying the water stored in cisterns in rural communities of Caraúbas/RN observed values between 0.04 and 8.48 UT, which is similar to those of the present study. As well, Dias (2016) obtained pH values in their analyzes between 0 and 8.4 UT, with an average of 1.1 UT.

**Electrical Conductivity and Resistivity**: Electrical Conductivity (EC) is resistivity is a measure that is equivalent to the ability of water to resist or conduct an electric current. It is used to quickly estimate the concentration of water-soluble ions or total salts, ie their purity. The presence of dissolved solids such as chloride, nitrate, sulfate, phosphate, sodium, magnesium, and calcium, iron and aluminum cations in water samples will conduct electrical current through it (Sagar; Chavan; Patil; Shinde and Kekane , 2015) (Rahmanian *et al.,* 2015) (Igbinosa and Aighewi, 2017) (Chughtai; Mustafa; Mumtaz, 2014). The values obtained are shown in table 3 where we can observe the EC and resistivity found in the physicochemical analysis of samples 1,2,3,4, 5, 6,7 and 8. The water EC ranged from 10.8 µS/cm at 146.9 µS/cm and resulted in an average of 79.9 µS/cm with an average temperature of 21.9 °C. Already the resistivity alternated from 8.8K to 22.6K with an average of 12.8K, which is worth remembering that this must have values above the EC, ie, the higher its values the better the water quality. Moreover, although not included in the ordinance, it is important to note that EC values below 100 µS/cm as in samples 1 (10,8), 2 (81,0),3(75,5),6(76,4)and 7 (44.7) mean a low mineralization of harvested rainwater. Low conductivity levels and high resistivity in rainwater suggest that the rainwater captured was not carried by dissolved salts or other impurities from the roof, gutters and pipes (Igbinosa and Aighewi, 2017). On the other hand, high conductivity and low resistivity may lead to a reduction in the aesthetic value of water, giving a mineralized flavor to water (Rahmanian *et al.,* 2015). In the water samples analyzed by Viriato (2011) the EC values were from 101.3 to 698.5 µS/cm; Dias (2016) found values from 61 to 685 µS/cm, with an average of 120 µS/cm; Cunha (2014) obtained a variation between 120 and 300 µS/cm, generating an average of 201 µS/cm; Morais *et al.* (2018) had an average result of 167 µS/cm, ranging from 112 to 234 µS/cm, values above the present research.

**Table 3. EC and Resistivity of rainwater samples stored in reservoirs in rural Condeúba**

| Sample | Electric Conductivity (µS / cm) | Temperature (° C) | Resistivity (Ωm) |
|---|---|---|---|
| 1 | 10.8 * | 22.5 | 8* |
| 2 | 81.0 | 22.1 | 1.8K12.3K |
| 3 | 75.8 | 22.1 | 13.1K |
| 4 | 103.9 | 22.2 | 9.6K |
| 5 | 146.9 * | 21.4 | 13.2K |
| 6 | 76.4 | 21, 8 | 13.1K |
| 7 | 76.4 | 22.1 | 22.6K * |
| 8 | 100.2 | 21.0 | 9.9K |
| Average | 79.9 | 21.9 | 12.8K |

Source: Research Data (2019); (*) Variation

**Total dissolved solids:** Total Solids Dissolved (TDS) is the total amount of mobile charged ions including minerals, salts or metal dissolved in a given volume of water in mg/L (Sagar; Chavan; Patil; Shinde and Kekane, 2015). In the case of rainwater, the TDS varies according to its volume of fall and thus, the higher the volume of rain, the greater the number of suspended particles and dust, consequently the TDS will increase(Chughtai;Mustafa;Mumtaz,2014). Table 4 reproduces the TDS values seen in the physicochemical analysis of samples 1, 2, 3, 4, 5, 6, 7, and 8 compared to the limit set in Consolidation Ordinance No. 5, 2017 Annex XX of the Ministry Health. The TDS of the water ranged from 5.46 mg/L to 51.8 mg/l and occurred at an average of 35.44 mg/L. For this parameter the rainwater samples stored in the reservoirs, in relation to the found values, as well as the general average are within the defined limit, thus identifying that the samples are suitable for consumption, in relation to the analyzed parameter. The average values found by Almeida (2018) for the water samplesof the Glênio Sá settlement cisterns in the municipality of Caraúbas/RNfor TDS are in a range of 4.1 to 52.2 mg/L, which is similar to the present study. Dias (2016), in his analysis, observed that the water stored in the reservoirs presented values between 31 and 342 mg/L, with an average of 60 mg/L. Cunha (2014) noted that in the collected samples, the values did not exceed the recommended values, with a variation between 60 and150 mg/L and an averageof100 mg/L, which is slightly above the found. Similar values obtained Morais *et al.* (2018) which ranged from 56 to113 mg/L.

**Table 4. TDS of rainwater samples stored in reservoirs in rural Condeúba**

| Sample | Total Dissolved Solids (mg / L) |
|---|---|
| 1 | 5.46 * |
| 2 | 40.6 |
| 3 | 38.1 |
| 4 | 51.8 * |
| 5 | 37.8 |
| 6 | 37.6 |
| 7 | 22.1 |
| 8 | 50.1 |
| Average | 35.44 |
| Consolidation Ordinance No. 5/17 Attachment XX of MS - 1000 mg / L | |

Source: Research Data (2019); (*) Variation

**Alkalinity:** Alkalinity is a chemical measure of water's ability to neutralize an acid. It also measures the buffering capacity of water or its ability to withstand changes in pH after the addition of acids or bases. The alkalinity of natural water is mainly due to the presence of salts of weak acids, although strong bases may also contribute, such as $OH^-$ (Sagar; Chavan; Patil; Shinde and Kekane, 2015). Given the above, although this parameter is not specified in Resolution Ordinance No. 5 Annex XX it is of great importance to assess the general quality of water. Moreover, by knowing the alkalinity of water, it becomes possible to define concentrations of flocculating agents, as well as the corrosive and fouling characteristics of the analyzed water. The results obtained are expressed in Table 5 where we can observe the alkalinity values found in the physicochemical analyzes of samples 1, 2, 3, 4, 5, 6, 7 and 8.

**Table 5. Alkalinity of rainwater samples stored in reservoirs in rural Condeúba**

| Sample | Alkalinity (mg / L) |
|---|---|
| 1 | 13.4 * |
| 2 | 41.4 |
| 3 | 41.4 |
| 4 | 52.0 |
| 5 | 61.4 * |
| 6 | 38 , 0 |
| 7 | 22.6 |
| 8 | 48.0 |
| Average | 39.8 |

Source: Research Data (2019); (*) Variation

Usually water samples with alkalinity below 40 mg/L tends to be more aggressive, with low amount of neutralizing agents, which resembles the general average (39.8 mg/L) and with samples 1, 6 and 7; for alkalinity between 40 mg/L and 100 mg/L water tends to balance which means that the base neutralizes the acid, as is the case with samples 2, 3, 4, 5 and 8; for alkalinity between 100 mg/L and 150 mg/L water has a slightly fouling character in which there is carbon deposition; and for alkalinity greater than 150 mg/L water becomes strongly incrustating (Malanda; Matini; Louzolo-Kimbembe; Mbayi and Mabiala, 2019). In the water samples analyzed by Morais *et al.* (2108) the values for alkalinity were from 8 to 92 mg/L, with an average of 39.5 mg/L, which is consistent with that found in the present study. The results found by Dias (2016) when studying the water stored in cisterns in rural communities of João Pessoa/PB observed values between 27.7 to 95.6 mg/L, with an average of 51.4 mg/L, which also approximates that obtained in this analysis. Viriato (2011), in his analysis, found values for alkalinity ranging from 16 to 58 mg/L.

**Total hardness:** Water hardness is expressed in mg/L calcium carbonate equivalent (CaCO3). Hardness indicates the concentration of multivalent cations in water, especially calcium ($Ca^{+2}$) and magnesium ($Mg^{+2}$), and to a lesser extent aluminum ($Al^{+3}$), iron ($Fe^{+2}$), manganese ($Mn^{+2}$) and strontium ($S^{+\ 2}$) (Silva; Brito; Duarte; Braz and Silva, 2017). The low hardness concentration is due to the low concentration of calcium and magnesium ions in rainwater. Therefore, it can be said that rainwater is not hard and can be used for washing purposes (Chughtai; Mustafa; Mumtaz, 2014). Although not of sanitary importance, the use of water with excess of these ions can lead, for example, at industrial level, to problems of scale, corrosion and loss of efficiency in heat transmission in boilers and cooling systems (MILL); Gonçalves; Saraiva and Oak, 2014).

**Table 6. Total Hardness of rainwater samples stored in reservoirs in rural Condeúba**

| Sample | Total Hardness (mg / L) |
|---|---|
| 1 | 26.8 * |
| 2 | 29.2 |
| 3 | 33.2 |
| 4 | 32.0 |
| 5 | 58.8 |
| 6 | 33.2 |
| 7 | 106.4 * |
| 8 | 65.2 |
| Average | 48.1 |
| Consolidation Ordinance No. 5/17 Attachment XX of MS - 500 mg / L | |

Source: Research Data (2019); (*) Variation

Table 6 shows the total hardness values found in the physicochemical analyzes of samples 1, 2, 3, 4, 5, 6, 7 and 8 compared to the limit set in Consolidation Ordinance No. 5 of 2017 Annex XX of Ministry of Health. The total hardness of the water ranged from 26.8 mg/L to 106.4 mg/L and gave an average of 48.1 mg/L. Related to this parameter the rainwater samples stored in the reservoirs, in accordance with the general average, as with the found values, are within the determined limit, thus representing that the samples are appropriate for consumption, associated with this parameter. A water is called very hard water when it has a calcium carbonate concentration greater than 180 mg/L; lasts between 120 and 180 mg/l, moderately lasts between 60 and 120 mg/l (samples 7 and 8) and soft when calcium carbonate levels are <60 mg/l (samples 1, 2, 3, 4 , 5 and 6) (BAGNARA, 2014). In the water samples studied by Viriato (2011) the values were below the limit allowed by the legislation and ranged from 39 to 80 mg/L. The values for total hardness in the samples studied by Almeida (2018) oscillatedbetween 44.14 and 63.76 mg/L. Dias (2016) in a study conducted in João Pessoa / PB found that the waters stored in the reservoirs had values between 30 and 160 mg/L, with an average value of 59 mg/L. In the water samples analyzed by Morais *et al.* (2018) the values for total hardness ranged from 18.8 to 86.5 mg/L, with a mean of 38 mg/L.

**Microbiological analysis:** To analyze the microbial quality of rainwater stored in the studied reservoirs two parameters were used, the presence/ absence of total coliforms and Escherichia Coli, through the IDEXX Colilert rapid test. According to the test, it is positive for coliforms when the samples were yellow in color; yellow/ fluorescent positive for *E. Coli*; colorless negative. According to Kaushik; Balasubramanian and Dunstan (2014). The microbiological quality of water is generally analyzed by identifying the presence of faecal indicator bacteria such as totail coliforms and *E.coli*. The presence of these microorganisms in water samples is used to indicate the presence of fecal pollution and the possibility that fecal pathogens may also be present, and E. *coli* is considered the best indicator of fecal contamination in water. Because of this, the presence of these pathogens in water is unacceptable from the point of view of public health, as it points to a great risk to health. Of the eight samples evaluated, immediately after reagent addition and incubation period in the greenhouse, all had yellow color that is indicative of total coliforms. When analyzing the presence/absence of E. coli, seven samples exhibited yellow / fluorescent staining after exposure to ultraviolet light (UV) and only one (sample 5) remained colorless. Thus, according to the Consolidated Ordinance No. 5 of 2017 Annex XX of the Ministry of Health the rainwater evaluated is not suitable for use due to the presence of these microorganisms in practically all samples, which according to analysis , should be absent in 100 mL. According to Dehghani-sanij *et al.* (2016) several reasons for the presence of microbial contaminants in reservoirs may be: entrance of any contaminants through ventilation through openings present in reservoirs; contamination due to human or animal residues entering reservoirs; and lack of timely dredging, cleaning and chlorination of reservoirs. However, it is known that the existence of total coliforms in the rainwater captured from the roof is predicted, since the roof is exposed to air and animal feces, rich in organic compounds and contributes to the development of microorganisms.

Based on the results found in the present study, we can compare them with similar researches that also involve the use of the Colilert IDEXX Enzyme Chromogenic Substrate technique for analysis of various water sources and that has been performed by several authors: In Barra do Bugres -MT, Ferreira (2017) through the colilert rapid test, detected contamination in the evaluated samples throughout the study period, which became alarming, since the contamination index predominated in almost 100% of the samples. It is understood that this index is due to the lack of basic sanitation in the region and also to the period of collection (rain). On the other hand Silva (2017) verified the microbiological quality (Total Coliforms and Escherichia coli) of the water that supplies seven public schools in the urban area of Esperança-PB, using the Colilert Enzyme Chromogenic Substrate method. Immediately after application of Colilert reagent and incubation for 24 hours at 37 ºC, it was observed that of the seven samples analyzed samples 6 and 7 were yellow, showing the presence of total coliforms. However, the presence of was not detected E. coli in any of the evaluated samples, as they did not exhibit fluorescence under ultraviolet light. Marquezi (2010) compared the efficiency of the rapid colilert method with the Colitag, when performing the analysis of the tap water and river samples it was observed that all samples showed contamination by total coliforms if E. coli in both tests. demonstrating the equality between the methods, so, in view of the similarity of the results achieved, any one could be selected for pathogen analysis. Sandri (2010) Examining the roof rainwater in the Boa Vista region, it was confirmed that in all samples the presence of total coliforms was found, which when quantified ranged from 90 to 16000 MPN / 100 mL. He also points out that the presence of total coliforms in roof rainwater is expected since the roof is exposed to air and bird droppings, being rich in organic compounds and contributing to the growth of microorganisms. Brooks *et al.* (2017) by verifying water quality in the Nyanza region of Kenya, compare concentrations Escherichiacoli qualitatively and quantitatively with the Colilert and compartment pocket test (CBT) in source waters (well, river, rain ) and drinking water stored in 35 households in western Kenya. Within the shared quantification range, concentrations E. coli enumerated with Colilert and CBT were similar and generated a significant correlation coefficient, 0.896 with a 95% confidence interval.
Invik et al. (2017) to explore techniques for describing the microbial quality of well water in rural areas made use of the Colilert IDEXX rapid test, taking into accountspatio temporal time series analysis, mapping and relative risk. Escherichia coli and coliform tests from public and private well waters were examined between 2004 and 2012 in Alberta, Canada. Overall, 14.6% of the evaluated wells obtained total coliforms and 1.5% of the wells were positive for *Escherichia Coli.*

Baum *et al.* (2014) conducted a study to examine the relationship between the microbial quality of drinking water and its source in the Puerto Plata region of the Dominican Republic, in which it sought to identify the presence / absence of E. Coli. In his study he analyzed 409 families in 33 communities. The results showed that 47% of the improved sources (rain, piping, well protected) of drinking water presented high to very high risk and therefore unsafe for consumption. However, in the surveyed communities, it could be seen that still a large portion of households consume water contaminated by microbes from improved water sources. Given the above and according to the quality of the waters analyzed, there is a need for greater care regarding the use of this source of water, which, despite being natural, depending on how it is captured and stored, may have substances and pathogens that alter their quality. For this, preventive and corrective measures can be used, such as: cleaning the roof and gutters before collection; always disregard the first rainwater before storing it in the reservoirs, which already helps in cleaning the roof; clean the reservoirs at least once a year; boil and filter the water before use; if necessary carry out chlorination.

## CONCLUSION

In the physicochemical determination of the quality of the rainwater samples stored in the reservoirs of rural areas of the municipality of Condeúba / BA, it was possible to find few variations compared to the standards established by the current Brazilian legislation, Consolidation Ordinance No. 5/2017 Annex XX On the other hand, when evaluating their microbiological quality, it was noticed the presence of pathogens that, according to the legislation in force, should be absent in 100 mL. Finally, it is concluded that a rainwater reserve system is efficient to supply water to a population, preserving its drinking use. It is recommended to study water potability alternatives, such as the use of operations such as filtration and disinfection with frequent monitoring of the water quality of these reservoirs by analyzing other parameters relevant to their potability.

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