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"PHYSICAL AND CHEMICAL EXAMINATION OF THE DRINKING WATER IN THE PAKHAR CHOURAKI AREA OF THE MANDAWAR TEHSIL IN DAUSA DISTRICT, RAJASTHAN"

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ABSTRACT

Growing urbanization has led to a rise in agricultural and other human activities, which have contaminated ground and surface water[19]. There is now insufficient demand for safe, clean drinking water, and the water that is available is now contaminated due to many factors. To improve the quality of drinking water, a variety of techniques and treatments are used. Water ought to be pure and uncontaminated by any kind of pollutants. All of its parameters, such as pH, conductivity, calcium, magnesium, total hardness, carbonate, bicarbonate, chloride, total dissolved solids, alkalinity, sodium potassium, and nitrate, should be within an allowed limit. These include organic and inorganic contaminants, heavy metals, pesticides, and more. Various samples were gathered from various sources for this purpose. Category 1: hand pump-operated boreholes with an average depth of thirty meters; Category 2: hand-dug, open wells without sealed walls with an average depth of sixteen meters. The physical-chemical and microbiological qualities of these samples (pH, conductivity, turbidity, hardness, and total dissolved solids) were examined in order to determine the level of contamination and offer suitable remedies. The human body develops a variety of ailments that are linked to contaminated water. Chemical testing can be used to identify it and then provide treatment strategies to make the water safe to drink. Every metric is validated through comparison with World Health Organization (WHO) guidelines. According to the results, categories 1 and 2 drinking waters do not have adequate quality, although they are also not within an acceptable range.

A clean and safe supply of drinking water[20] is a basic human necessity. All pathogens and chemicals must be removed from water (Riaz and Zia, 2020) [3]. The WHO[21] estimates that 75% of infections in developing nations are mostly caused by contaminated drinking water. Therefore, it is necessary to address the water's bacteriological, chemical, and physical properties (Padda and Asim, 2019) [4]. The water quality index is influenced by several factors, including pH, turbidity, dissolved oxygen, and electrical conductivity. The WHO defines an acceptable pH range as 6.5–8.5. For people to maintain normal bodily processes, pH levels must be within a certain range. Enzyme activity and electrical conductivity are regulated by it in the body (Behailu et al., 2018) [5]. According to (Nejat et al. 2018) [6], the optimal pH for drinking water is neutral; however, if the water becomes basic or acidic, its quality deteriorates. The water quality index is impacted by turbidity, which is the amount of suspended solid particles, both organic and inorganic (Khalid et al., 2018). Industrial pollution and salt contamination produce total dissolved solids (TDS), which indicate whether a substance is safe to use or not. Increased turbidity will result in poor water quality, possibly unfit for human consumption (Nejat et al., 2018) [6]. If water hardness exceeds 200 mg/liter, it can lead to scale buildup in the distribution system and exceed 500 mg/liter, which is hazardous to human health (Lafta, 2017; Walia et al., 2017) [8,9]. In order for the body to produce energy, oxygen is essential for controlling all metabolic processes.

INTRODUCTION

Two important issues in developing countries are unclean drinking water and insufficient water supplies. A significant issue facing our nation is access to clean drinking water. Eighty-four percent of the world's population—or 783 million people—live in rural areas and lack access to clean water, according to the joint monitoring program (JMP) for water supply and sanitation, which was established by UNICEF and the World Health Organization (WHO) and attributed to poverty.

Figure 1. Essential parameters of drinking water quality

The biological oxygen demand test uses dissolved oxygen (DO) to measure the polluting potential of waste water in milligrams per liter. (Alam et al., 2017) [10]. The water quality index rises until oxygen concentration reaches 100 mg/liter; at that point, the quality index falls and water quality deteriorates (Rahmanian et al., 2017; Divya and Neetu, 2017) [11,12]. An investigation carried out at Araba Minch Town reveals abnormal fluoride and chloride levels. According to (Sanaullah et al. 2016) [13], all other parameters are within an acceptable range. A second study was done that focuses on the water quality standards of drinking water sources used in public transportation. It is concluded that the water is not suitable for drinking due to bacterial contamination, high chloride levels, and alkalinity (Mahajan et al., 2016; Shahid et al., 2015) [14,15]. In underdeveloped nations that must combat the diseases brought on by contaminated water, unsafe drinking water is a major problem. The World Health Organization administers the Joint Monitoring Program (JMP) for sanitation and water supply (Tariq, 2014) [16].

According to studies from the World Health Organization (WHO) and UNICEF, 2.5 billion people lack access to adequate sanitation, and 783 million people worldwide—or 11% of the world's population—do not have access to safe water (84% of whom reside in rural areas) (Arora et al., 2014) [17].

Environmental factors, urbanization and soil erosion, fertilizer and pesticide use in agriculture, industrial operations, and human water exploitation all affect the quality of water. Although groundwater is the least contaminated, criteria for water quality must be maintained, according to (Yadav et al. 2013) [18]. Water containing inorganic substances and heavy metals has the propensity to build up in human organs and interfere with regular organ function. Lead (Pb), arsenic (As), magnesium (Mg), nickel (Ni), copper (Cu), zinc (Zn), and nickel (Ni) may be harmful to human health and the environment (Alam et al., 2017) [10].

Arsenic is poisonous, carcinogenic, and causes problems with mitosis, cell respiration, and cell enzymes. Humans can be exposed to lead through their diet or water supply. According to the World Health Organization (2011) [21], damage is caused even at low concentrations. It's really poisonous. Mercury exposure leads to behavioural and neurological issues. 4. Chloride in water can have negative health effects on people and give water an unpleasant flavour.

1. PROBLEM STATEMENT

Water contamination these days is mostly caused by pollutants that enter the water from many sources, such as sewage and industrial waste. Human health could be impacted by this, which could lead to illnesses with various symptoms.

The purpose of this research is to:

- To Evaluate the physical parameters (pH, turbidity, conductivity, taste, and odour) of drinking water in order to determine its quality.
- To evaluate drinking water quality using chemical parameter testing (lead, fluoride, arsenic, and chloride).

2. MATERIALS & METHODS

The research region under study is Pakhar Chouraki, which is situated in Rajasthan near Dausa district. Pakhar is among the most developed areas. There are four designated regions in this zone: Kesara & Kesari, Mahwa, Mandawar, Pali. Most of it is a rural area with little access to clean drinking water.

The water table's depth varies from place to place. Water quality is assessed for drinking reasons through chemical and physical testing, and samples are gathered from various sources. Two distinct categories within a single area are used to gather water.

Category 1: Boreholes with hand pumps (30 meters)

Category 2: Open dug wells with concrete walls. (Depth 16 meters)

Water from various sources has been chosen from the Pakhar Chouraki region for the investigation of categories 1 and 2, respectively.

Sr. No.	Village	Source Mode Use
1	Pakhar Chouraki	Category 1
		Category 2

Table 1. Primary Water Sources of the Targeted Villages

3. RESULTS & DISCUSSIONS:

Physical quality parameters, including colour, odour, temperature, turbidity, pH, Total Dissolved Solids, Total Suspended Solids, conductivity, Total hardness and Alkalinity are measured on the collected samples.

Description	Area	Unit	Category	
			Category 1	Category 2
Colour (Hazen)	A1	Hazen	<5.0	<5.0
Odour	A1	-	Agreeable	Agreeable
Temperature	A1	°C	25.0	25.0
Turbidity	A1	NTU	<1.0	<1.0
Total Dissolved Solids	A1	mg/L	4198	4208
Total Suspended Solids	A1	mg/L	4.0	4.7
Total hardness	A1	mg/L	1085.0	1093
Alkalinity	A1	mg/L	1179.0	1171
Conductivity	A1	µs/cm	4226.0	4237
pH Value	A1	-	7.49	7.46

Table 2. Results of Physical Parameter of Drinking Water

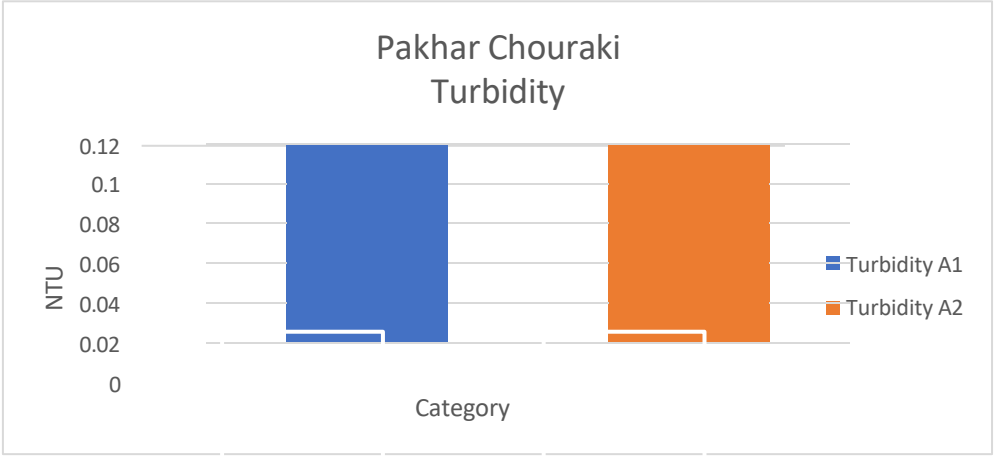

Figure 2. Turbidity at different category

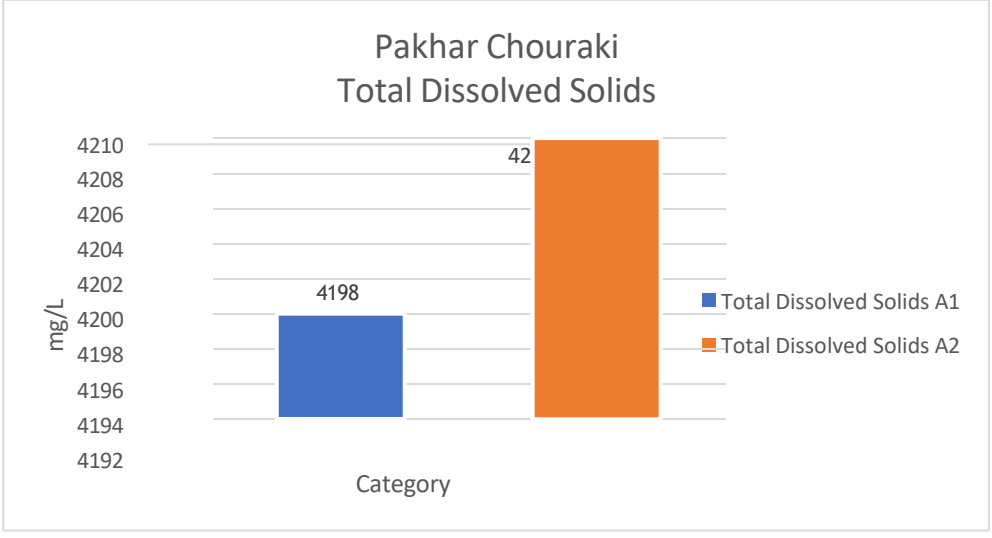

Figure 3. Total Dissolved Solids at different category

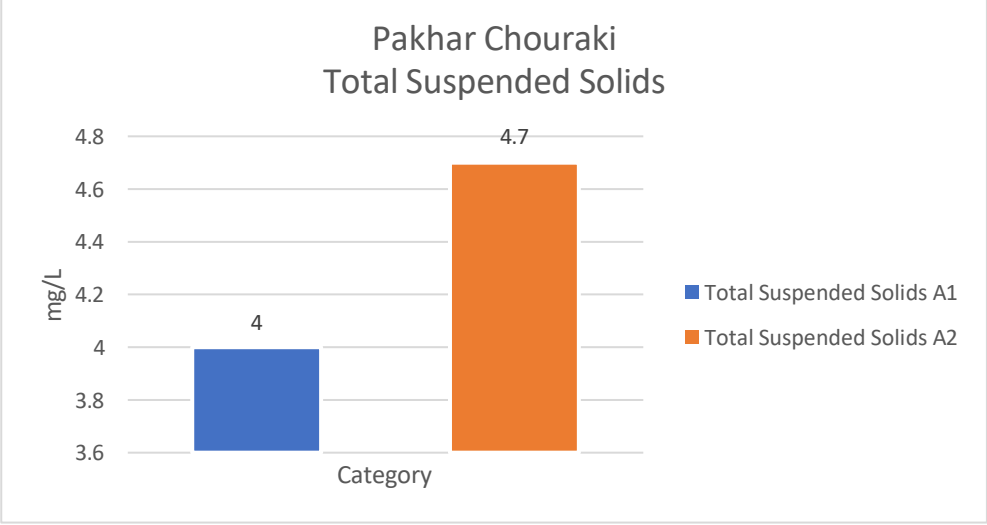

Figure 4. Total Suspended Solids at different category

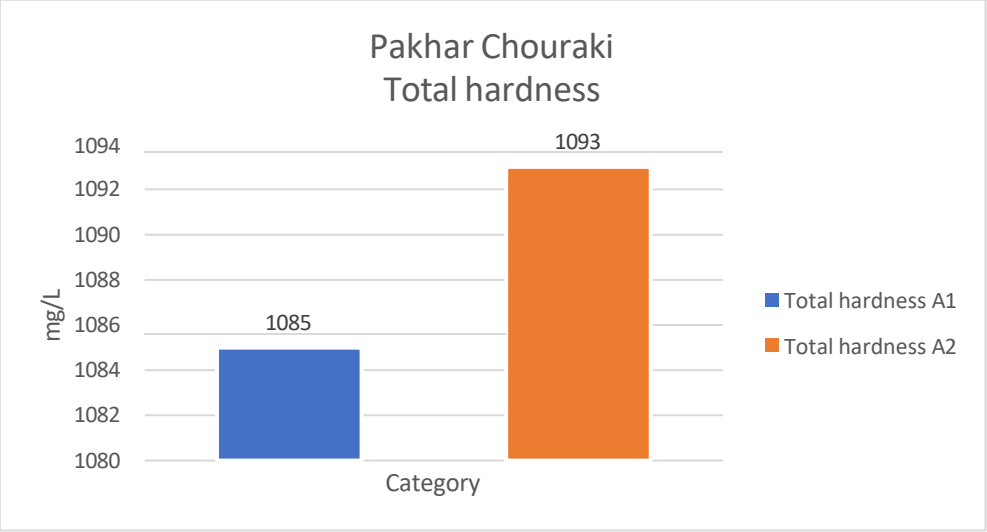

Figure 5. Total hardness at different category

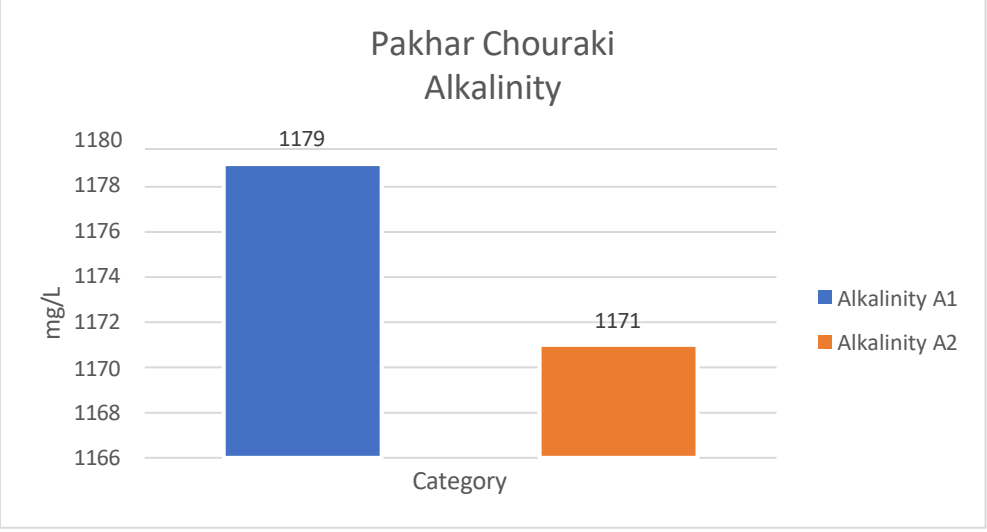

Figure 6. Alkalinity at different category

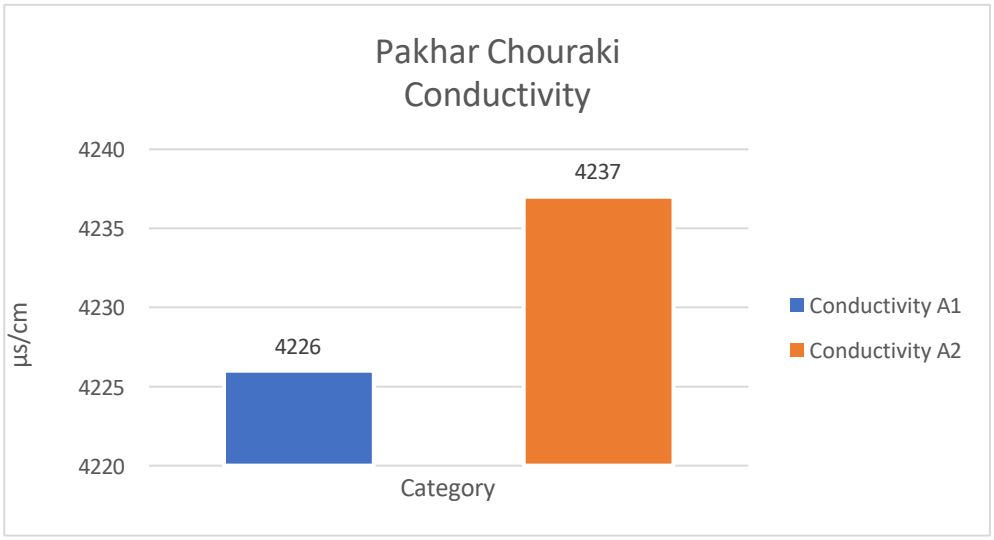

Figure 7. Conductivity at different category

The pH of the majority of the sources is lower than neutrality. While surface and piped waters were almost neutral, boreholes and open wells usually had low pH levels. Although the WHO and Rajasthan Environmental Protection Department recommend a pH range of 6.5 to 8.5, there is no health-based recommendation for this level. Low pH levels thus have an indirect impact on human health since heavy metals discharged into water from pipes can harm humans and could lead to serious illnesses (Figure 8, Table 2)

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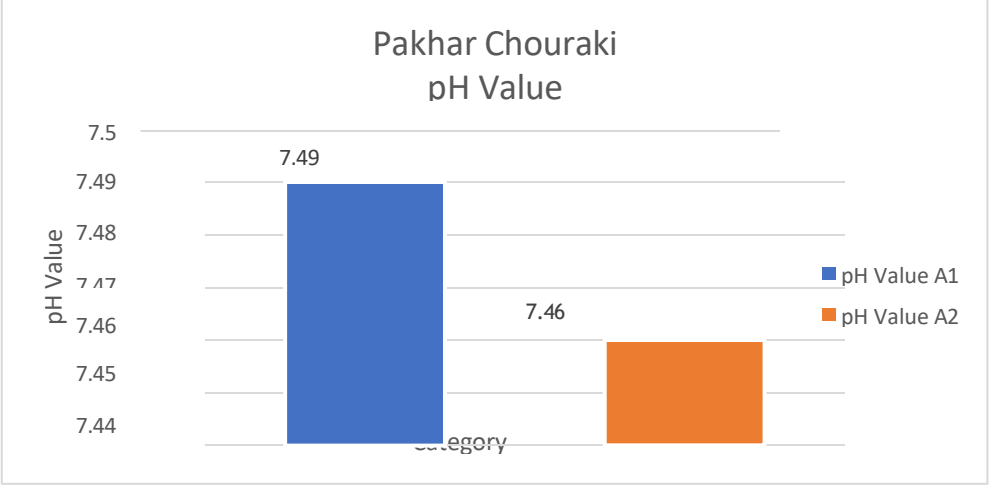

Figure 8. pH Value at different category

Analysis of chemical quality, including fluoride, nitrite, nitrate, sulphate, phosphate, Dissolved Oxygen, Biochemical Oxygen Demand 27° C @ 3 days and Chemical Oxygen Demand is done to determine the rate of contamination. A lack or excess of chemically recognized salts can lead to illness, a lack of fluoride in the water can cause tooth decay and osteoporosis and a host of other small alterations can occur in the human body (Table 2).

Description	Area	Unit	Category	
			Category 1	Category 2
Fluoride	A1	mg/L	<0.1	<0.1
Nitrite	A1	mg/L	BLQ (0.1)	BLQ (0.1)
Nitrate	A1	mg/L	8.0	7.6
Sulphate	A1	mg/L	96.0	103
Phosphate	A1	mg/L	10.0	10.4
Dissolved Oxygen	A1	mg/L	7.96	7.87
Biochemical Oxygen Demand 27° C @ 3 days	A1	mg/L	<1.0	<1.0
Chemical Oxygen Demand	A1	mg/L	<1.0	<1.0

Table 3. Results of Chemical Parameter of Drinking Water

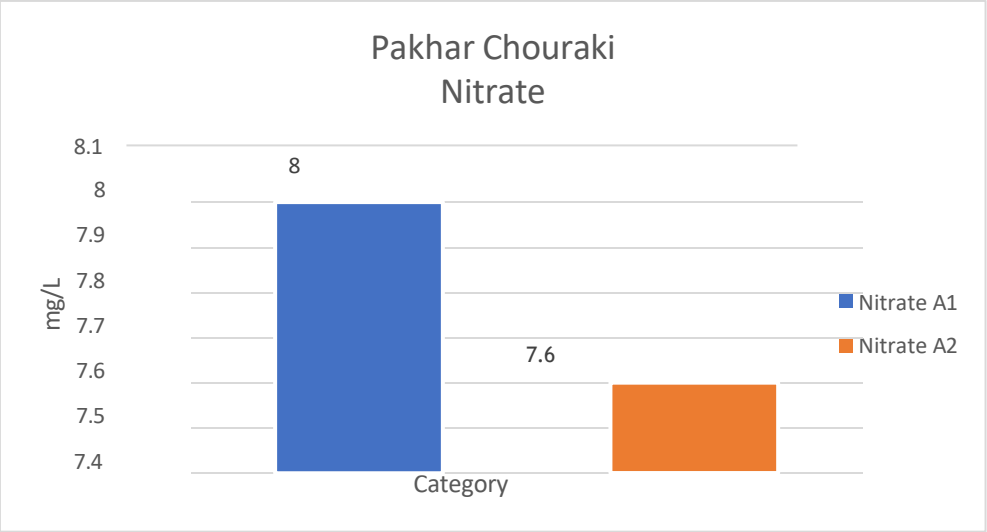

Figure 9. Nitrate at different category

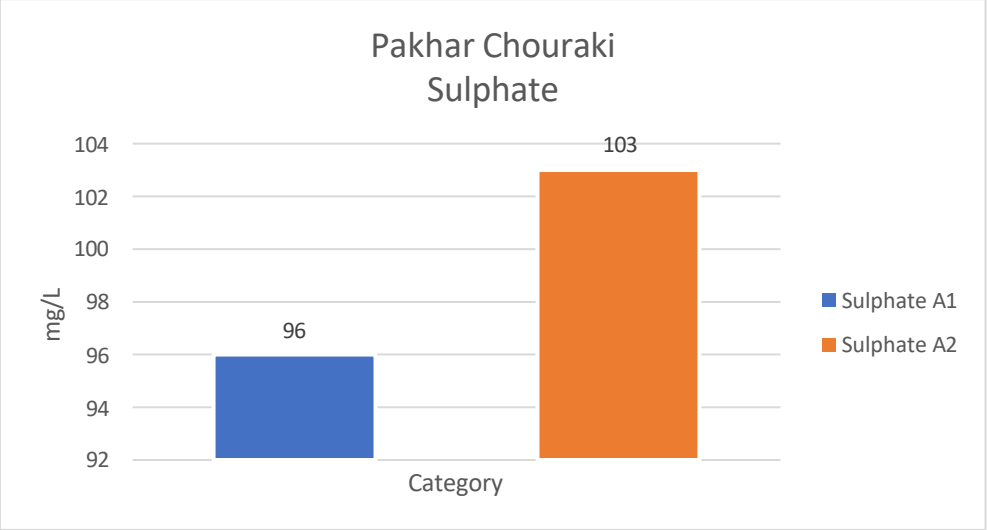

Figure 10. Sulphate at different category

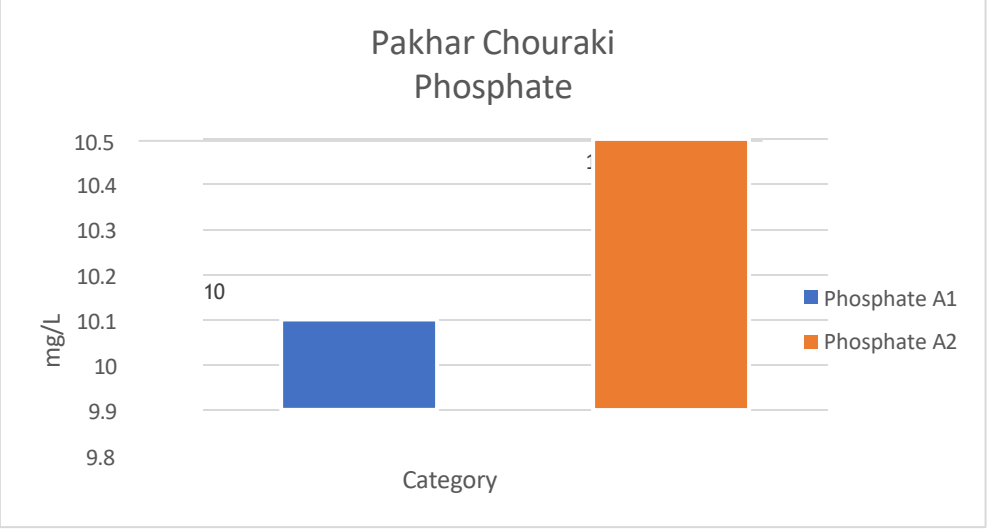

Figure 11. Phosphate at different category

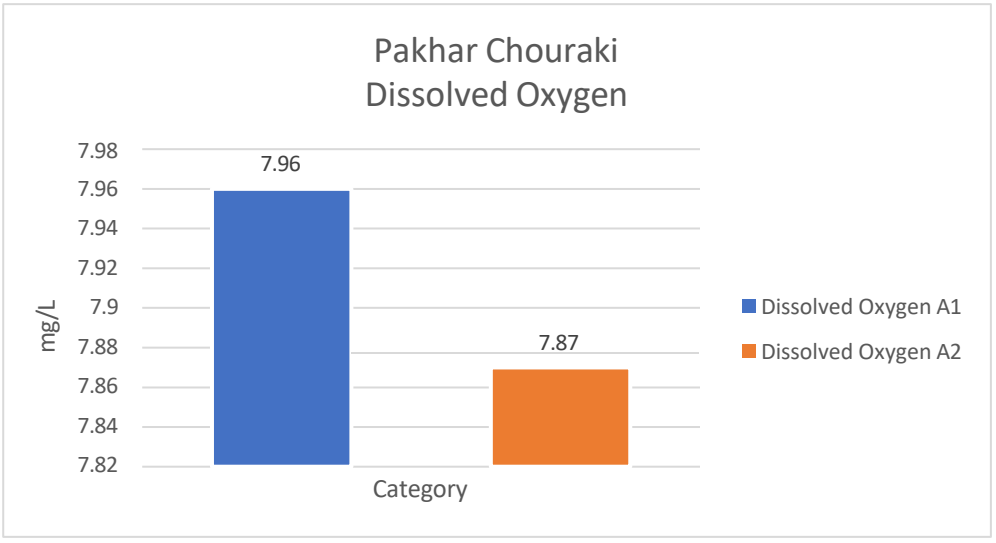

Figure 12. Dissolved Oxygen at different category

A lack of iron, aluminium, copper, zinc manganese arsenic, cadmium, silver in the water can lead to anaemia and different problems in human body; an excess of lead in the water can cause learning disabilities, hearing impairments, and shorter stature in children; and contaminated water can cause a variety of health issues, such as bad tastes and odours, an increased risk of cancer, an increased risk of asthma attacks, and heart problems.

Different concentration of minerals is present in water. With the presence of these minerals either in excess or lack, human body can be affected and may suffer many diseases. (Table 4)

Description	Area	Unit	Category	
			Category 1	Category 2
Aluminium	A1	mg/L	BLQ (0.005)	BLQ (0.005)
Copper	A1	mg/L	BLQ (0.005)	BLQ (0.005)
Zinc	A1	mg/L	BLQ (0.01)	BLQ (0.01)
Iron	A1	mg/L	BLQ (0.01)	BLQ (0.01)
Lead	A1	mg/L	BLQ (0.005)	BLQ (0.005)
Manganese	A1	mg/L	BLQ (0.005)	BLQ (0.005)
Arsenic	A1	mg/L	BLQ (0.005)	BLQ (0.005)
Cadmium	A1	mg/L	BLQ (0.005)	BLQ (0.005)
Chromium	A1	mg/L	BLQ (0.005)	BLQ (0.005)
Silver	A1	mg/L	BLQ (0.005)	BLQ (0.005)

Table 4. Results of Heavy Matel Parameter of Drinking water

CONCLUSION

The research has led to the following conclusions:

1. Odor and turbidity should be absent from drinking water. Because the physical parameters are within an acceptable range, categories 1 and 2 are superior to the others.
2. Hand pumps and piped water have good physical quality; other sources of drinking water have poor quality because of pollutants, particularly lead and chlorine, which can cause diseases in people.
3. Chemical pollution of drinking water sources is sufficient. It is not advised to drink water if pollution levels are higher than allowable thresholds.

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