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Estimation of heavy metals (As/Cr/Cd) and various water quality assurance parameters of groundwater samples obtained from Jageer Katkair, Muzaffarabad

Abstract

The article presents a summary of the key findings from significant physicochemical parameters of drinking water, particularly screening for heavy metals and pathogenic microorganisms for Jagheer Katkair, Muzaffarabad Azad Kashmir. The drinking water quality is determined using the drinking water quality index (DWQI), which is based on turbidity, EC, Ca+2, and Mg+2. In Jagheer Katkair, Muzaffarabad Azad Kashmir, drinking water security is significantly damaged continuously due to unsettling population growth and hasty waste sludge. In Jagheer Katkair, Muzaffarabad Azad Kashmir, about 8% of the entire population has access to secured drinking water. Leading to a shortage of resources for safe and healthy drinking water, the residual 92 % is compelled to use contaminated water. Microbial contamination, turbidity, electrical conductivity, and hardness are the main sources of contamination since they are often released into water system supplies. About 60 to 70 percent of all malignancies are attributable to anthropogenic exercise-induced bone ailments. This study focused on the drinking water quality, sources of contamination, and water control methods in Jagheer Katkair, Muzaffarabad Azad Kashmir. To confront the depressing water contamination stats of Jagheer Katkair, Muzaffarabad Azad Kashmir, there is an immediate commitment to implement preventative measures and treatment technologies.

Keywords: water quality, hydrochemistry, surface water, WQI, Muzaffarabad

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Introduction

Safe drinking water is both a fundamental requirement for good wellbeing and essential basic freedom. Drinking water quality is a general term that relates the creation of water to the impacts of regular cycles and anthropogenic exercises. Substance impurities happen in drinking water all over the world and change the nature of water, which could threaten the body. To some degree, the genuine creatures' creation structure has achieved a high thickness of animals in some regions, conveying tremendous measures of compost. Along these lines, the creatures' creation has become disconnected from its property base and encounters issues in treating the manures inside the internal organization. This issue has incited regular issues for people, including water corruption and smell defilement.[1] Both ordinary and anthropogenic activities are answerable for the abundance of weighty metals in the environment.[2,3] Regardless, anthropogenic activities can without much of a stretch, produce heavy metals in wastewater that debase the marine environment.[4] The rising tainting of heavy metals has a basic antagonistic prosperity impact on individuals.[5,6] In the amphibian environment, the residue has been extensively used as a biological pointer for the assessment of metal defilement in ordinary water.[7] The investigation of weighty metals in water and buildup could be used to study the anthropogenic and current impacts and perils introduced by waste deliveries on the riverine natural framework.[8–10] Thusly, it is vital to check the centralization of weighty metals in water and sediment of any dirtied riverine natural framework. Nowadays, weighty metal tainting is an essential issue in many agricultural countries like Pakistan.[8] Because of synthetic communications between water and land conditions, various substances are found in groundwater in different fixations. As a result, a few examination concentrates have been led to evaluate groundwater quality and wellbeing chances presented by poisonous and minor components like Cr, Cd, As, and Pb, mainly from nations like Pakistan, Bangladesh, India, China, and others in Southeast Asia. It is affirmed that water can cause illnesses in individuals. It has been seen that the runs and different infections in people are brought about by the microbes which live in consumable water. The characteristics of water extend, as do biological and anthropogenic components.[11] The World Health Organization assessed that up to 80% of all illnesses on the planet are brought about by a lack of sterilization, contaminated water, or inaccessibility of water.[12] The overall objective of the flow work is to assess the idea of drinking water sources and the transport system of the region, Jageer Katkair. The specific objections of the review region are:

I. To inspect bacterial pollution at the source and in the transportation system
II. To determine the genuine idea of drinking water
III. To survey basic weighty metal degradation in drinking water assets and transport structures, metal debasements are minerals-based, which happen conventionally or get into the watershed through current deliveries.
IV. To coordinate the situation assessment of drink drinking-capable sources and springs.

Material and methods

Study area

Muzaffarabad's affiliation leading group is Jageer Katkair, which is located in the north and north-east of Dana, in the north-south of Tehsil Dhirkot locale Bagh. It is surrounded only by snow-covered peaks, some of which rise above 6000 meters above sea level. The survey was conducted in different neighborhoods: Jageer Katkair, Muzaffarabad, Azad Jammu, and

Kashmir, Pakistan. The topography of the survey area is abrupt and most people are used to dwelling in minimally dispersed towns subject to ordinary springs, particularly wells and streaming water channels all around them as their fundamental wellspring of water (drinking and family use). The area was truly affected by October 2005. The environment of the area is dry to the semi-dry subtropical central area with colossal periodic assortments in the two temperatures and precipitation. Summers are typically warm and long, and winters are generally mild. The majority of the rainfall in this area occurs during the rainstorm season (July-August). In winter, the remainder of getting a low-power shower, the most blazing months are May and June, with a mean temperature of 40°C January is around 16°C and the lowest temperature is everything is around 1500 millimeters. This study will explore the underground drinking water nature of the town of Katkair, Muzaffarabad. No review was directed to demonstrate the nature of water in Jageer Katkair. Subsequently, this study is directed at Jageer Katkair, Muzaffarabad to look at drinking water quality and recommend proper water-treated systems Figure 1.

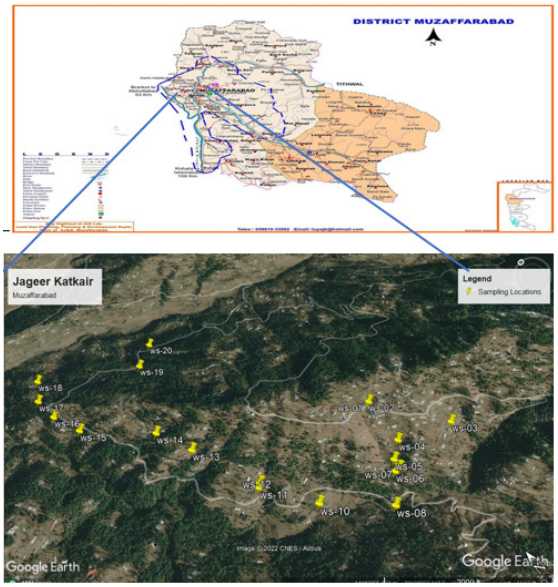


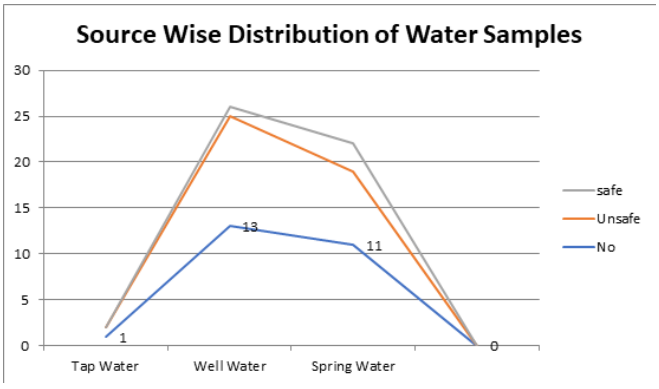
Figure 1 Study area and sample location specified area.

Samples location

A drinking water quality investigation of Jageer Katkair Muzaffarabad has been done a total of 25 erratic examples were assembled from springs, Bore, and well water. Standard strategies and shows were set for the grouping of water examinations, recording, and association of data surveys of water tests and improvement of GIS information collection for DWSS (Table 1), Graph 1 and spring water quality outline of the town of Jageer Katkair in Muzaffarabad, AJK. Evaluation of any water tests begins appropriately at the site. During testing, one prerequisite is to reveal remarkable thoughts to block the interference of any external parts that could change the formation of an example and affect the results. Water tests for physicochemical examinations were assembled in polystyrene compartments with a 1-liter breaking point. The table underneath shows the source-wise circulation of water tests. Before analyzing, the containers are washed thoroughly 2-3 times, first with water and then a short time later with refined water. For bacterial assessment, tests were accumulated clearly in cleaned holders outfitted with a field-testing pack (water check, ready faction, MERCK). Boric destructive was used as an added substance in the inspecting bottles for nitrates and nitrogen before moving to the field.

Table 1 SoSource-wise distribution of water samples

Sources	No	Unsafe	Safe	%age	Causes
Springwater	11	8	3	72	E.C, Turbidity, B.C
Well Water	13	12	1	92	E.C, Turbidity, B.C,
Tap Water	1	1	0	100	Turbidity, Ca, Mg



Graph 1 Source-wise distribution of water samples.

Data acquisition

Exercises during sampling coded on model jugs with very sturdy markers. Filling of the data combination structure Recording of GPS sorts out on looking at the site, Preservation of tests Bacteriological examination of all assessing areas, naming and stepping of tests after tests, and passing of tests to the water testing lab within 5-6 hours. A positive lab test for microbial and compound boundaries is then finished in the lab. To avoid even a little change in the association of tests because of external impedance, it is guaranteed that such assessment starts within 4-6 hours right after the social affair test. The assessment of compound limits is done with the help of a high-tech spectrophotometer, the Lovibond XD 7500. Limits such as pH, separated oxygen, conductivity, temperature, and turbidity are measured using sophisticated multi-boundary equipment.

Heavy metals analysis

For heavy metal analysis, 100ml of water samples were taken in Teflon bottles flushed with refined water. The examples were kept for the time being after adding 5ml of HNO3. Afterward, the examples were separated and put away in a dull and dry spot until examination (EPA, 1995). The investigation of weighty metals (Cu, Cr, Cd, Fe, Pb, and As) was completed utilizing a fire photometer (PERKIN Elmer AAS 700). Each example was investigated in copy. The standard arrangement of weighty metals was ready from a stock standard arrangement of 1000mg/l for the alignment of the nuclear assimilation spectrophotometer. An arsenic investigation was performed nearby by the Arsenic unit (Hanna, 2100). Charge balance blunders are not entirely set in stone for each water test. Water tests having high levels of cations show positive charge balance errors (CBE) whereas water tests having high centralization of anions show negative. Equation (1) was used to calculate the charge balance error (CBE). CBE = [Σcataions−Σanions] [Σcations+Σanions] X100 Where centralizations of particles in identical plants are reported per liter (meq/l) to the standard conventions, only those water tests that show 5. Here acknowledged the end goal of drinking. Aquachem writing computer programmers are used to study the various constructions of water (total hardness, TDS, Piper graphs, DO, and Durov chart). To oblige water quality extent, first, every one of the nine rules is endorsed by weight (WI), considering their importance to the all-around nature of

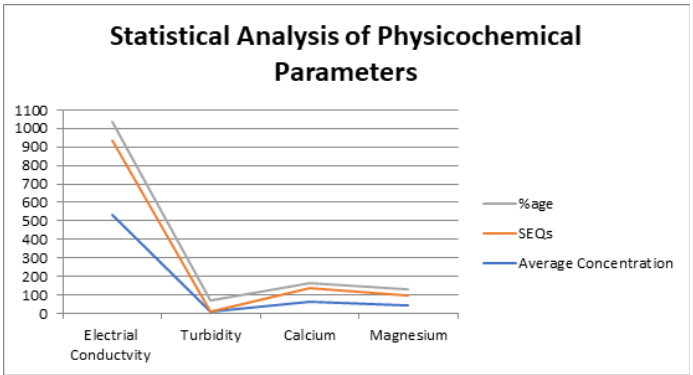
drinking water. Broken-up salts, sodium, and chlorides are given a heap of 4 because of their results in drinking water, while bicarbonates are given a heap of 1 due to their minor work. Another framework is in 1 and 4 given their effect on water quality. After picking the heaviness of the water limit, the relating weight (WI) was not entirely settled by using this condition (2). WI = $wi/\sum 1\ wi\ n\ i$ (2) Where in this situation, WI is the relative weight, wi is weight-connected with each limit, and n is some of its boundaries. The next step for finding out the WQI is to consign the water quality rating scale for each boundary. The water quality rating is not entirely settled by the accompanying condition (Equation 3). Qi =Ci/Si×100 (3) Where qi is the quality rating scale for each boundary, Ci is the centralization of physiochemical boundary communicated in mg/L, and Si is the norm for all of the boundaries communicated in mg/L. The sub-file (SI) is the suggested standard of its boundary, not entirely settled by the accompanying condition (Equation (4)). SIi = WI ×qi (4) WQI = $\sum$ i=1 SIi (5), Where SIi is the subindex of the ith boundary, nWI is the general load of the ith boundary, Qi is the rating scale in view of concentrations of the ith boundary, and n is the number of parameters.

Results and discussions

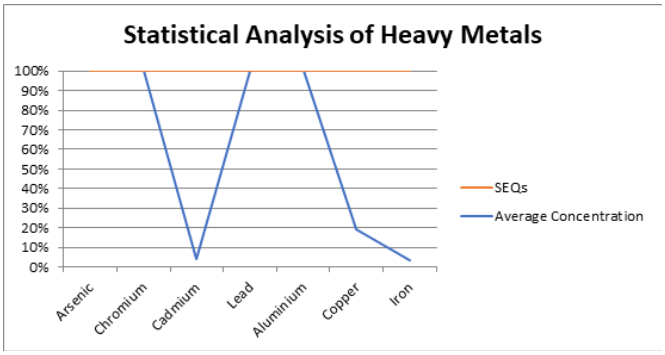
By and large, the ground nature of Jageer Katkair (concentrate on region) isn't reasonable for the end goal of drinking. The table below demonstrates those values over the passable level of the NDWQs or PEQs norms Table 2, Graph 2, 3.

Table 2 Statistical Analysis of Physicochemical parameters

Index	Unit	Min	Max	Mean	SD	WHO Guidelines	%age
EC	µS/cm	417.6	657.7	535.6	72.4	400	100
pH	-	2.29	8.47	6.73	0.99	6.5-8.5	
Turbidity	NTU	2.01	9.08	6.57	1.67	5	56
TDS	Ppm	226.2	361.9	284.1	36.6	<1000	
Ca	Mg/l	28	112	63.2	20.2	75	24
Mg	Mg/l	7.29	79	43.8	19.1	50	36
TH	Mg/l	52	485	335.1	86.2	<500	
K	Mg/l	0.7	7.6	1.8	2.06	12	
Na	Mg/l	1.7	14	6.12	3.57	200	
No2	Mg/l	0.01	0.81	0.14	0.17	<3	
No3	Mg/l	0.2	4.6	1.59	1.4	<50	
Cl	Mg/l	6.7	24	14.8	5.18	<250	
SO4	Mg/l	0.27	27	15.1	7.05	<250	
F	Mg/l	0.02	0.9	0.4	0.31	1.5	
NH4	Mg/l	0.01	0.089	0.03	0.02	1.5	
PO4	Mg/l	0.02	0.09	0.05	1.2	0.1	



Graph 2 Statistical Analysis of Physicochemical parameters.



Graph 3 Statistical Analysis of heavy metals.

Electrical conductivity

The intermingling of particles in water builds its electrical conductivity. Electrical conductivity is entirely dependent on the number of broken-down solids in the water, and EC values can be used to calculate TDS. As demonstrated by WHO rules, the EC value shouldn't outperform 400S/cm yet. The momentum examination revealed that EC regard goes from 417.6–656.7 inside the moderate worth of 535.7S/cm. These results especially uncover that water in the audit district was not extensively ionized and has a minor level of ionic mix activity due to minimal broken-up solids. Out of 25 examples, the electrical conductivity of all examples outperforms the limits. Conductivity doesn't have an obtuse brunt on human prosperity (Table 3). High electrical conductivity could edge towards cutting down the upscale worth of water by giving it a mineral taste. In any case, the ordinary conductivity level in the audit locales isn't much more than what is represented by another examiner.[13,14]

Table 3 Statistical Analysis of Heavy Metals

Index	Unit	Min	Max	Mean	SD	SEQs	% age
As	Mg/l	0.0007	0.0041	0.0027	0.0028	<0.05	-
Cr	Mg/l	0.001	0.03	0.012	0.002	<0.05	-
Cd	Mg/l	0	0.0046	0.0004	0.0013	0.01	-
Pb	Mg/l	0.01	0.1	0.03	0.02	<0.05	-
Al	Mg/l	0.001	0.19	0.05	0.08	<0.2	
Cu	Mg/l	0	1.9	0.48	0.5	2	
Fe	Mg/l	0.01	0.04	0.01	0.008	0.3	

Turbidity

Turbidity in water is decided through the amount of solid count number suspended in it. The study area obtained a turbidity level of 0.01-6.02 NTU, inside the average of (2.76NTU) and the WHO recommended value of 5 NTU. Out of 25 samples, 14 samples exceeded the boundaries of (WHO) 's encouraged cost., higher than the PEQs and WHO recommended fee of 5.00 NTU.

Calcium

In the earth's structure, calcium is the fifth most abundant part and plays a basic part in bone planning and cell physiology. Calcium is one of the key synthetic elements for human well-being in groundwater.[15] As shown by WHO standards, the sensible extent of calcium in drinking water shouldn't exceed 75 mg/L. In the audit districts, the calcium concentration ranged from 28-112 mg/L. Along these lines, most of the examples were well beyond what many would consider possible. In the assessment by Q Zhang et al.[16] a similar

generally raised degree of calcium was recorded. The accompanying techniques are utilized to eliminate hardness as a result of calcium and magnesium. Synthetic interaction for bubbling hard water. Adding Slaked Lime (Clark's Process) by adding washing pop, The Calgon process, the Particle trade process, and the use of particle trade gums.

Magnesium

The eighth most abundant part of the earth's crust and an ordinary constituent of water is magnesium. It is critical for the suitable working of living animals and is found in minerals like dolomite, magnetite, etc. According to WHO rules, magnesium levels should be under 50 mg/L in drinking water. The centralization of this part in the focus district went from 7.29-79 mg/L, and the most raised regard that was recorded was higher than many would consider possible. Water conditioners are consistently used to dispirit calcium and magnesium hardness in water by a trade interaction. The calcium and magnesium are taken out of the water and sodium is incorporated in their place. Iron and manganese ejection is accomplished in basically the same manner by exchanging the iron and manganese for Sodium.

Heavy metals

Aluminium

Aluminum salts are conventionally added as coagulants during water treatment to kill turbidity, normal matter, and microorganisms. Aluminum is also a contaminant found in other water treatment engineered materials and can enter drinking water through large mortar lines or linings. In the review region, the outcome shows that the lead concentration goes from 0.001 to 0.19 mg/l with a normal value of 0.05 mg/l. The degree of aluminum in every one of the gathered examples is underneath the endpoint. The examples are good for drinking regarding aluminum tainting.

Copper

Copper is a metal that occurs ordinarily and is used to make various things, including parts for plumbing systems. Copper can get into our drinking water as the water goes through our family's pipe system. The WHO value of copper in drinking water is 2 mg/l. In the review region, the outcome shows that the grouping of copper goes from 0 to 1.9 mg/l with a normal value of 0.48 mg/l. The degree of copper in every one of the gathered examples is underneath the endpoint. The examples are good for drinking concerning copper defilement.

Iron

There are two kinds of iron in water: solvent ferrous iron and insoluble ferric iron. Water containing ferrous iron is clear and dull, when presented to air, it becomes blurred, uncovering a grim gritty-hydric iron empower. There is no iron tainting in any of the examples. How much iron in the examples gathered is inside as far as possible.

Cadmium

Cadmium is found in zinc, lead, and copper minerals, as well as coal and other oil-based merchandise, shales, and during volcanic discharges. When in contact with low fulfill-scale separated solids (TDS) and acidic fluids, these stores can go about as focal points for ground and surface waters. In the review region, the outcome shows that the grouping of lead goes from 0 to 0.0046mg/l with a normal worth of 0.004mg/l. The degree of cadmium in every one of the gathered examples is underneath the endpoint. The examples are good for drinking with regards to cadmium defilement

Chromium

Chromium is a scentless and dull metallic part. Chromium is found ordinarily in rocks, plants, soil and volcanic buildup, and animals. Trivalent chromium is the most perceived type of chromium found in ordinary waters in the environment. In the center region, the outcome shows that the convergence of chromium goes from 0.001 to 0.03 mg/l with a normal value of 0.012 mg/l. The degree of lead in every one of the gathered examples is underneath the endpoint. The examples are good for drinking regarding chromium tainting

Lead

Lead can enter drinking water while plumbing materials that contain lead disintegrate, especially where the water has high causticity or low mineral content that polishes off lines and establishments. The most notable wellsprings of lead in drinking water are lead lines, nozzles, and mechanical assemblies. In the review region, the outcome shows that the convergence of lead goes from 0.1 to 0.01mg/l with a normal value of 0.03mg/l. The degree of lead in every one of the gathered examples is below the limit. The examples are good for drinking regarding lead pollution.

Arsenic

Inorganic arsenic is the sort found in spoiled drinking water and is the most damaging sort of arsenic. This kind of arsenic is, in a similar manner, found in rice, cereal grains, and different food assortments. Regular arsenic is formed when arsenic gets together with carbon. It is the most common sort of arsenic found in food. This analysis revealed that the arsenic esteem is within the allowable range. All examples gathered are protected regarding arsenic tainting.[17–31]

Conclusion

In this study, the grab sampling strategy was used to gather the samples, and an examination to decide the level of debasement in the groundwater was performed. The results implied that the water was inadmissible for drinking. It contains an elevated degree of electrical conductivity, turbidity, calcium, magnesium, and a similar level of coliform. The result of tests taken from the specific point shows various kinds of examples of corruption. The groundwater quality is under the PEQs and WHO rules for drinking. 25 limits, including physical, chemical, and organic, were exposed to examination. By far, most of the compound boundaries are over the limits. The electrical conductivity (EC) is high. In 21 of the 25 examples, all the coliforms were found as natural spoilage. Electrical conductivity was 100%, turbidity 56%, calcium 24, magnesium 36, and coliform 92% of the total. This increases the level of compound present examples. The EC remains higher in all examples. According to data provided by nearby emergency clinics, the excess of such examples is bound to cause free insides, cholera, and typhoid. The survey's findings may provide local experts with a better understanding of the rhythmic movement conditions of drinking water and their associated infections. The possible recommendations ending the further spoiling are as follows: paved the leakage, particularly near the home or neighboring areas. Recognize or observe non-point sources of contamination that may contaminate drainage and, eventually, groundwater.

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Conflicts of interest

The author declares there is no conflict of interest.

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