



## GROUNDWATER CONTAMINATION, ITS HEALTH HAZARDS AND CLIMATE JUSTICE: A CASE STUDY OF FAISALABAD

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### ABSTRACT

Globally, groundwater has been a significant source of fresh water but in some regions the chemicals from the industries made it contaminated. This study emphasizes on the quality of ground water; its consequences on health and the water inequalities it brought with it. Thus, firstly evidence from the previous literature has been taken and then primary data collection has been done to assess this in a case study area. The data has been collected from the industrial area of Faisalabad through unstructured and semi-structured interviews (n=15) from the local community, government and non-governmental organizations and hospital staff. The sample has been selected through convenient sampling and purposive sampling. After the data collection, the data has been assessed through the thematic analysis technique. The findings proved that the groundwater quality is poor making the water unfit for drinking and daily use. This contaminated water further lead to diseases such as respiratory diseases, cancer, skin diseases, mental distress and infectious diseases. Moreover, the water inequalities identified in the study area are found to be either based on economic status, location or age. For instance, in the study area residents do not have access to clean water and they cannot afford to purchase mineral bottles. The women and children are at greater risk of these health issues. The study also found out that not a single organization is addressing the issues of the locale of this study. Thus, this study brings to light the issues of the study



*area bring them to the attention of the government and NGOs so that policy makers may consider them while taking decisions. At the end of this study, recommendations have been given for the consideration of the policy makers and future researchers.*

**Keywords:** Groundwater contamination, climate justice, NGOs.

## INTRODUCTION

Human-induced climate change is brought about by a range of gases that incorporates carbon dioxide, methane, nitrogen gases, and chlorofluorocarbons. Around 57% of these gases' impact is driven via fossil fuel byproducts from burning petroleum products, and coal-terminated power plants are liable for 40% of fossil fuel byproducts on the planet (Mitchell, et al., 2006).

Groundwater is a significant source of fresh water for the worldwide populace and is utilized for homegrown, horticultural, and modern purposes. Around 33% of the worldwide populace relies upon groundwater for drinking water and it has been described as an important store of water to provide resilient against drought in the perspective of climate change (Shamsudduha, 2013). Water pollution is a major problem in Pakistan as quality of the drinking water is improperly managed and supervised, therefore, a threat to quality of groundwater also poses a threat to quality of drinking water. In the drinking water quality index which measures the quality of water, Pakistan ranks 80 among 122 countries (Azizullah, et al., 2010). At present, industrial wastewater is posing a threat to the availability of stored water and its quality. In emerging countries, the condition is bad where over 90 % of raw sewage and 70 % of raw industrial waste are thrown into groundwater (Ilyas, et al., 2019).

The adverse consequences of defiled groundwater on human well-being are persistent and are extremely challenging to recognize (Chakraborti et al. 2016). For instance, many examinations have shown that elevated degrees of fluoride, nitrate, metals, and diligent natural poisons are a health menace for people (Wu, et al., 2020).

Faisalabad is a contributor of more than 20 percent to Punjab's GDP averaging around \$20.5 billion. The textile zone is one of the contaminating areas in the world (Banuri, 1999). The textile industry is related with several environmental harms such as soil contamination, noise pollution, air/dust pollution, and water contamination. The groundwater used in the household also causes different diseases like diarrhea, waterborne disease, stomach problem, and skin problem is the leading cause of death in infants and children. The groundwater used in the household as a tap water also causes different diseases like diarrhea, waterborne disease, stomach problem, and skin problem is the foremost reason of death in infants and teenagers. The key source of water contamination is industrial wastewater. Long-lasting use of polluted and fluoride-contaminated drinking water causes skin pigmentation and skin cancer (Thakur et al., 2013).



This research paper has been done to look at groundwater contamination and its health hazards and to consider these from a justice perspective. Moreover, this research paper aims to capture the water inequalities in Faisalabad and the scenario of climate justice here.

### **Prevalence of Groundwater Contamination**

Groundwater is a basic source of fresh water that has been used for drinking and other domestic, agriculture and industrial processes by masses. However, some of the industrial practices are a hazardous to the quality of groundwater (Li, 2020). Some groundwater contaminants are Nanoparticles, microplastics, pesticides, hazardous metals, hydrocarbons, and trace organic pollutants (Li and Wu, 2019). Furthermore, in their study, Raja, et al (2021) explore the contaminated heavy metal in an industrial area in India. According to their investigation, the Pb, Cd, Ni and Cr are the heavy metals who has more potential to contaminate the groundwater.

In various nations, groundwater is an excellent means of water for household, agricultural and everyday use. India gains 2.2 percent of the vast worldwide land and 4 percent of the worldwide water assets, and 16% of the total populace. It is presented that almost 33% of the public use contaminated groundwater for drinking (Malyan, et al., 2019). Subsequently, water quality apprehensions and its organization choices require more consideration in emerging nations. Expanded request of groundwater assets in India is likewise significant because of bad farming practices. Water quality is particular to natural and man-made impacts alongside local environment, physical or land elements and irrigation practices (Boyd, 2019).

Groundwater is exposed to different sources of contamination because industrial revolution along with the absence of enthusiasm for manmade effluents and their possible effect on groundwater. Singh & Singh, (2011) examined the effect and range of ground water contamination in a rustic area in Punjab, India. The outcomes of the study specify that drinking water is tainted with low quality and causing various health issues. Some governmental efforts and awareness is needed but then again only 13 percent people trust in government efforts.

### **Health consequences related to groundwater contamination**

Pawari and Gawande (2015) clarified that the greater part of the disorders that influence the increase in death rate of people are connected with water quality. Schwarzenbach et al., (2010), as of late, because of anthropological activities, the groundwater quality has diminished step by step which are brought about by degradation or overexploitation or by a blend of both. The various domestic and industrial activities make complex issues.

Groundwater contamination can influence human wellbeing, ecological eminence, and financial turn of events. For instance, many investigations have revealed that elevated degrees of fluoride, nitrate, metals, and persevering natural contaminations are a wellbeing threat for human inhabitants (Wu et



al. 2020). This is particularly basic for babies and youngsters who are more vulnerable to the impacts of these toxins than grown-ups (He et al., 2020; Karunanidhi et al., 2021).

According to Manda, Suzuki, and Talanta (2002), a number of health issues are plaguing local populations, some of which may be directly or indirectly related to the flow and release of waste water. For instance, the high pH levels of the water, that can undoubtedly cause skin irritation and cause blisters, may be a contributing factor in skin issues. Sayal, et al., (2016) studied the cause of human illnesses and concluded that a large number of the health diseases are aquatic with their course of action as to move directly through the intestinal tract or through contact with contaminated food and water. Nearby communities of the industrial wastewater passages are relatively more unprotected to the hazardous health consequences caused by these pollutants.

### **Climate Justice and Ground water Contamination**

Climate change is the biggest humanitarian challenge confronting humanity today. The technologically advanced economies of the world contribute to the most of worldwide greenhouse gases outflows. Yet, the more unfortunate and least advanced countries are hit hardest by its effect (Hogget, 2012). The Intergovernmental Panel on Climate Change (IPCC) was set up in 1988 by the World Meteorological Association (WMO) and the United Nation Environmental Program (UNEP) to give patterns in environmental change. In their most memorable report, in 1990, they showed that climate change is a reality and that it is brought about by anthropogenic activities (Joshi and Amadi, 2013). In 2000, the main climate change summit was held in The Hague.

Industrial wastes, the waste release from various enterprises and treatment plants, are expanding dramatically because of the absence of satisfactory administrative strategies and execution thereof.

### **The case scenario in Pakistan**

Industries are likewise a significant means of surface and groundwater contamination in Pakistan. They discharge their effluents into adjacent streams, streams, lakes and agrarian fields, which from one viewpoint cause illnesses and on the other debase the general water quality. These include: substance manufacturing, fertilizers and insecticides, textiles, tanneries, concrete, electrical gear, glass and tiles, mash and paper sheet, and petrol processing plant (Siegmann and Shehzad, 2006). These industries, overall, have no installations for the conduct of wastewater before discharge either into metropolitan manure organization or straightforwardly into a close by channel. Just 21 from 1,000 enormous industrial entities of material, steel and others in Lahore have effluent treatment places (Murtaza, et al., 2012). Additionally, industrial sites in Faisalabad, Karachi, and Peshawar likewise discard their effluent into open places.

Groundwater close to sewer pipes is likewise exceptionally contaminated and is ill suited for human utilization (Farid et al. 2019). It causes serious worries for networks and urban communities that rely



upon groundwater to meet their drinking water needs. While measuring the threat of natural arsenic pollution, Podgorski et al. (2017) discovers that groundwater in Pakistan covers multiple times more arsenic than WHO standards for drinking water rules, making the water unsuitable for human utilization.

According to Khan and Mohsin (2021), Patients with diseases connected to water and sanitation issues, like cholera, typhoid, diarrhea, hepatitis, giardiasis, cryptosporidiosis, and guinea worm infections, occupy 20 to 40% of the beds in Pakistani hospitals. Rasool, et al (2016) in their research work examined the presence of heavy metals in tube well water in some areas of Punjab. Their findings revealed that there is higher level of toxic metals in tube well water which comes with many risks for the local residents. Additionally, this contaminated water is not good for drinking and agriculture purposes.

Injustice as far as climate implies that the most impacted communities have added the least to greenhouse gases outflows like marginalized individuals. Justice in such manner expects that the worldwide local area should give the essential resources to all nations, particularly the most weak ones like Pakistan. Another significant idea is that of multifaceted: environmental change fuels existing social, financial and health disparities. The improvement disparity across Pakistan ought to likewise be viewed as in battling climate change (Jain and Jain, 2022).

Pakistan is among the world's main 10 countries generally impacted by climate change. An unnatural weather change is brought about by uncontrolled and unabated ozone depleting substances discharges. Carbon dioxide (CO<sub>2</sub>) discharges for the most part produced by industrialized countries are causing significant damage in unfortunate nations (Rasul and Ahmad, 2012).

Pakistan is trying to cope with climate challenges, though it is already too late and climate change means an existential threat to the country. Even if Pakistan boasts early achievements in the pursuit of Sustainable Development Goal 13 (Climate Action), it is still very vulnerable to climate change. Within the country, it is affecting deprived communities with additional vigor. Therefore, it is significant to bring forward the concept of Climate Justice: it is necessary to fairly distribute the costs and benefits of addressing climate change. Climate Justice acknowledges how the repercussions of climate change on poor and communities of colour around the globe are disproportionate (Ajani and Geest, 2021).

In Pakistan, every fifth of citizens suffers from disease due to polluted water usage. In Faisalabad also, groundwater quality is extremely poor (Yamin, et al., 2015). Even though the UN officially recognizes water and sanitation as human rights, it can be difficult to track access to potable water. Thus, at this time it is essential to overlook the serious health consequences proffered by groundwater contamination and the uptake of climate justice to reduce these effects. Otherwise, with time these inequalities will expand resulting in serious health and financial implication.



## **RESEARCH METHODOLOGY**

This study is qualitative because it aims to fulfill the research objectives and uses qualitative research methods for this investigation. Furthermore, this is an ethnographic study with an interpretive approach to the research. This approach includes researchers deciphering components of the investigation. In this manner, interpretive coordinates human interest in research. Also, interpretive focusses on the significance and may operate various plans to imitate multiple chunks of the concern. The interpretive approach be subject to a naturalistic methodology of information assortment such as interviews and observations (Onwuegbuzie, at el., 2010). Besides, this study is based on the exploratory research design.

### **Methods**

The data has been gathered through unstructured and semi-structured interviews. As unstructured interviews are overwhelmingly utilized in personal exploration. The strength of unstructured interviews is the practically unlimited opportunity they give regarding content and design. (Mueller and Segal, 2014). In addition to it, to give the support and strength to the findings semi-structured interviews have also be done.

An interview-based primary data has been gathered from the unit of data collection about their perception on diseases born by people, the ways in which the used water affect them, the consequences they face because of contaminated water, their perception of climate justice and the solutions in the Small Estate Industrial area Faisalabad. The data has been collected through different phases. Initially, the researcher prepared the interview guides, then through key informants and friends in the hometown researcher reached out to the participants. Then, the data was gathered from them by the researcher by interviewing them on skype and call. At first, the interviews were recorded, then all the recordings were transcribed. All the interviews were firstly transcribed in the national language of the country (Urdu) then it was translated into English.

### **Study Area**

This study's area is Faisalabad, and it has been selected as the locale as it has the most significant number of industrial zones in Pakistan. Faisalabad is also called the "City of Textiles" because the number of industries grouped in the district of Faisalabad is broad. The textile industry is the pillar of the economy of Faisalabad. All these industries play a vital part in the growth of Faisalabad, contributing five billion dollars of yearly textile exports from the Faisalabad textile industries. However, Faisalabad textile industries are a significant polluting source, apart from the leather and sugar industries. Small Estate Industry Area located in district Faisalabad is the most industrialized area in the province of Punjab.



## **Data Collection Procedure**

The units of data collection has been selected based on their relevance with the study. UDC 1 is the local community, they are the people living in the industrial area for so long and are being exposed to the contaminated groundwater and its consequences. They can direct information about the influence of this phenomena on their lives and health. The UDC 2 are the officials of government and non-governmental organizations, these include the organizations or industries which are responsible for the groundwater contamination and may have the responsibility to bring climate justice. The third UDC are hospital staff, they are the source of pertinent information about health related effects and consequences of groundwater contamination. A sample of 15 respondents was taken from the resident of the small estate in Faisalabad. This study analyzed and interpreted the collected data by familiarizing it, making codes, and generating themes.

## **RESULT AND FINDINGS**

### **GROUNDWATER QUALITY**

The selected area of this study is an industrial area comprising of many textile industries. All the respondents of the view that the toxic chemical effluent from the industries contaminated the ground water. The participants from UDC 1 experience that the water is not clean from its color, taste and odour. One of the respondent from UDC 1 said that, 'The groundwater here is used for drinking either it is tap water or boring but often it has a bad odor of chemical and sometimes the taste of water also get changed which is not bearable. Some people then use that water for household chores while for drinking they use mineral bottle or filtered water from other areas. But the poor people like us who do not own car or motor cycle to get filtered water on daily or weekly basis and cannot afford mineral bottle left with no choice but to use this water. We boil this water before drinking for making it drinkable but it does not affect the taste of the water much.'

Yamin, et al., (2015) in their study evaluated the quality of groundwater in the different areas of the Faisalabad. The finding of their study shows that in the industrial area of Faisalabad either in the city or near drains the quality of drinking water is not good. They compared the quality of that water with the standard quality mentioned by WHO, and thus on the basis of that declared the water unfit for drinking. The participant's statement also indicates that poor people have less available alternatives, as they are unable to afford to purchase drinking water in bottles or sachets.

### **HEALTH EFFECTS ASSOCIATED WITH IT**

The contaminated water has been used by all the community members in the industrial area. The groundwater has been used for irrigation, drinking and the same water is running in the taps of the houses for daily use in the houses for their own consumption. As the groundwater is contaminated it is posing health problems for the habitants who gets in contact with the contaminated water. One of



the main issue that has been seen in the respondents because of contaminated water is respiratory issue. This has been supported by the studies that textile industries are more responsible for polluting the water and causing several health issues for the human health.

Mental distress is another main issue that is present in the study area. As the area get polluted by the contaminated groundwater it poses serious issues to the place and habitants. This makes it clear that the health issues from groundwater contamination are making inhabitants mentally depressed, they are just not aware of the seriousness of this issue. However, in recent times, some of them are aware that this is making them upset and seeking treatment. This can be the factor to mentally disturb someone as according to a study, bad odors are strongly related with the negative mood conditions (Horton, et al., 2009).

Although the groundwater is mainly use for drinking but here inhabitants use it for daily use too in all household chores and for cleaning/bathing/washing. Thus, this way the get in contact with water often. The findings reveal that the community or sensitive inhabitants do face the issues of skin diseases. As the same contaminated groundwater is used by the people of all the ages, the ones with the sensitive skin are more prone to it. Most of the people do not take it serious and knows about the complications of it if they went to hospital for treatment of if they search about it on google (mostly educated adults). However, the proportion of these people is very less. Besides, as the children or new born babies are more sensitive and people are more concerned about them, thus the cases of babies and children related to skin diseases are more.

Another most prevalent health related issues are the infectious diseases. These diseases are spreading rapidly in the area. These days in Faisalabad, dengue is spreading immensely and hospitals are filed with the patients of dengue. Dengue is spread by mosquitoes and the current increase in cases has been attributed to the widespread flooding in Pakistan 2022 (WHO, 2022), which in turn has been related to climate change. Amidst this dengue outbreak, the usage of contaminated groundwater deteriorates the condition of patients. One can say that respondents are more prone to infectious diseases and the cases of these diseases are also more. People do take this health issue serious and these days as the cases of dengue are more thus it weakens the immune system of patients and make them more vulnerable and prone to other infectious diseases.

## **FINANCIAL BURDEN**

The groundwater contamination bring a financial pressure on the inhabitant of industrial area of Faisalabad. The local people of this place has to bear the expenses of hospital, medicines and water. One of the respondent from hospital said that, our hospital is the only big hospital in this area which provide treatment of all the diseases and have qualified doctors. Numerous patients come here for check-up but the fee of doctor is quite high. Along with that the medicines here are not free and quite expensive for patients. The hospital do run many tests for the proper check-up which also cost them. The government or hospital is not providing any facility or concession for the treatment of patients



here.'

This shows that poor people face more the financial burden as they are the one living near the industrial area and drain and thus are more vulnerable to groundwater contamination.

## **WATER INEQUALITIES**

Groundwater contamination do have health issues and financial burden on the inhabitants of the industrial area of Faisalabad but these impacts are also subject to inequalities. These in equalities are also based on different factors.

The inequality has been seen among the sample of population in relation to the access of water. The safe drinking water is the right of all the people but everyone is not have access to safe drinking water. As mentioned by one of the respondent that the quality of water is very poor and does not taste and smell well, hence safe drinking water is not available to them. The findings shows that the safe drinking water is only available in the industrial areas of Faisalabad to those who can afford the mineral water. Otherwise the poor people cannot afford this and also do not have access to filtered water.

The water inequality has been in terms of location too. The data has been collected from the different areas of Faisalabad. Although the safe drinking water is not available in almost all areas but the people that are living near the textile industries and drains appears to be more vulnerable and deprived of clean water. One of the respondent said that, The water was not like this before, but after the industry has been built here, now the taste of water is different and its smell is different too and often it is not drinkable. However, my brother live 15 km far from here and water of their home is quite different and better.'

This indicates that the condition of water is likely to be worse near the industrial area.

In the study area although all the people of the community face the consequences of groundwater contamination, however, the women are more vulnerable. The women are the part of the community which are responsible more for household chores in the study area. They tend to do washing clothes, dishes, cleaning of house, thus they are more prone to skin diseases and other infectious diseases. It is clear that women are more exposed to the contaminated water and they are also facing the water inequality. The women living in posh area and the one living near industrial area do not get the same quality water. This also implies that all these inequalities are in terms of standard, the poor are more vulnerable and are victim to this issue.

As per the respondents, in the study area people are living of different ages and they all are subject to the negative consequences of groundwater contamination. However, the extent of the consequences they face can differ. The response from the respondents shows that in the study area the old and



children are more prone to the health issues. Obviously the old people, infant and small children are sensitive and their immune system is not that strong, thus they are more prone to the diseases and the risk of them getting the health consequences are more.

### **ROLE OF NGOS IN ADDRESSING WATER INEQUALITIES**

The NGOs worldwide had a huge role in addressing the inequalities but in the studied area. In Faisalabad there are many NGOs but no one is working to address the water inequalities especially in the industrial area. The results show that inhabitants do not want the industries in their community and want it either to be shut down or shift them to be in far flung areas from the living areas. They are also upset by the NGOs that although they are established to help us but they are not doing anything for our betterment. On the contrary, the NGOs do claim that they are working for the betterment of community and doing the needful but what they are doing is very little. Although they are doing some work related to cleaning and arranging awareness campaigns for environmental protection, sustainability, and green Pakistan but their approach and incentives are not addressing the issues faced by groundwater contamination.

### **ROLE OF GOVERNMENT ORGANIZATIONS TO BRING CLIMATE JUSTICE**

The country is bound by the pact to decrease the carbon dioxide emissions and planning to meet the SDG 13th goal of climate action. But government is at the starting level of planning out strategies but still they are not doing anything to bring climate justice. Especially in Faisalabad there is no single organization which is working to bring climate justice or diminish the existing water inequalities in the industrial area. The results deliberated that government is aware of the need to tackle the issues emerging from climate change and trying to cope with them in their own way which are not in accordance with the need of inhabitants of study area. Besides, they are not aware of the climate justice and thus not doing anything to bring climate justice. The government here is just focusing on reducing the carbon emissions to control the pollution. However, climate justice is a broader and important phenomena which need to be addressed. The government is mainly responsible to make an impact, thus, they need to diverge their focus.

### **CONCLUSION AND RECOMMENDATIONS**

This study explored the groundwater quality and its impact on the health of the industrial area in the Faisalabad. Besides, it also looked into the water inequalities and the role of NGOs and government institutions in eradicating water inequalities and bringing climate justice. The statistics show that drinking water aquifers close to wastewater pipelines are significantly contaminated and unfit for human use. In order to provide the population who live in the regions where this issue persists, it is necessary to investigate other sources of drinking water, particularly the pumping of high-quality drinking water close to rivers. Moreover, the water is used for drinking, cleaning, household chores and irrigation which bring out many health problems on residents of the place. The findings reveals



that the most common diseases are the respiratory issues, cancer, skin diseases, infections and mental distress. The inhabitants of the industrial area are also facing the financial burden and they are thus vulnerable in both the ways. Furthermore, the water inequalities are experienced in the study area on the basis of the access and location. Poor people and the people who are living near the industrial area do not have access to the safe drinking water. Climate justice is necessary in this case to address the inequalities but the government and NGOs are not doing anything in this regard. Thus, there is a need to do some specific policy changes and implement some strong strategies.

### **Suggestions**

Throughout the data collection some of the respondents give some suggestions to improve their condition. Some of the respondents are of the view that they should be facilitated in the hospitals by the government. Some public hospitals should be established in the study area which less fees of doctors and other facilities. There should be some health quota for poor people like health card initiative by KPK government. Moreover, the prices of medicines should be reduced. The government should put a levy of fixed prices for medicines that would be affordable for the poor people. Moreover, the industries should be accountable by government to take measures to reduce the groundwater contaminations.

Furthermore, government should start some initiatives to provide us safe drinking water. If there would be some filtered plants in the study area that would be great. Filtered water plants and tap water in every street or community would be very helpful. We then do not have to go to far places or have to pay great amount for clean water.

Besides, NGOs should focus on our health and financial issues too, based on groundwater contamination in the industrial area. They further collaborate with government institution, this will be beneficial to get the support early as the government initiatives or programs usually take more time to implement.

### **Limitations**

This research paper is subject to many limitations. One of the major constraint to this study is of time. This study is very complex and need thorough assessment, however, the time to complete the data collection, interpret the data and arrange it was short. Moreover, there was a limitation financial limitation, because of which it was difficult to travel the study area and interview the respondent face to face. This reduce the chance to get thorough information from the respondents. Besides, there was limitation based on sample size, for instance, the sample size of this study was 15 which is very small. This limitation is linked with the limitation of time constraint, as small sample size was taken because of the short time period for the data collection.



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