Clean Drinking Water Issues in Rural Community of District Mardan (Pakistan)

Adnan Khan[1], Malik Muhammad Shafi[2], Shah Fahad[3], Fazal Hanan[4] and Naushad Khan[5]

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Abstract

Water has a vital role in the socioeconomic condition of the country. Water is essential for agricultural production and plays a significant role in health. The present study was held in District Mardan Since 2024. The core objectives of the study were to examine issues related to clean drinking water and to find problems and constraints faced by rural communities for drinking water in the study area. District Mardan consist of three Tehsils namely Katlang, Tahkth Bai and Mardan. At the same time, two villages, Lundkhwar and Parkho Kali, were purposively selected based on more issues related to Thakhth Bai drinking water. The total of households in both villages was 1190. By Yamani Formula, the sample was fixed to 299. Through allocation proportion methodology, 299 were distributed among the two villages. Descriptive statistics and the Chi-square test were used for data analysis to investigate the overall significance of the results. The results show that the association between air pollution, rusted pipes, low-income, and open sewerage systems was highly significant at 0.05 confidence level. In contrast, other independent variables, i.e., water, birth disease, water drainage system, low water pressure, septic tank, and chlorination, had insignificant associations with water quality at 0.05 confidence level. The study recommends that the government facilitate rural communities by providing clean drinking water and bringing awareness regarding water-related issues; the government should control the problems related to the study area to escape the study area from the attack of disease.

Keywords: Clean Drinking, Water Issues, Rural Community

Introduction

Water plays a vital role in human life and is an essential component of the environment. The role of water in sustainable development as renewable is limited. Life can't exist without water, and it's replenished during the hydrological cycle process. It is essential for human socioeconomic development. Only a tiny portion of the earth's water is in underground aquifers, rivers, lakes, glaciers, and reservoirs, with most of the world's water remaining in the oceans and seas. However, 71 percent of the earth is covered by water; only 3 percent consists of freshwater, and roughly one-third is inaccessible.

Water concealments are more than two-thirds of the earth's surface; however, they are primarily salty and unfit for human consumption. Only 2.7 percent of the available freshwater on the planet is accessible, and only 1% is usable. Most available freshwater resources are inaccessible due to buried parts of the hydrologic cycle and glaciers, implying that safe drinking water on Earth makes up just 3% of total freshwater resources. (Dinka, (2018). Pakistan is one of the

[1]*Institute of Development Studies, Faculty of Rural Social Sciences. The University of Agriculture, Peshawar.*
[2]*Institute of Development Studies, Faculty of Rural Social Sciences. The University of Agriculture, Peshawar.*
[3]*Department of Rural Sociology, The University of Agriculture, Peshawar.*
[4]*Department of Sociology, FATA University FR Kohat. Email: drkhan@aup.edu.pk*
[5]*Institute of Development Studies, Faculty of Rural Social Sciences. The University of Agriculture, Peshawar.*

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few nations with the lowest access to clean drinking water. In our country, twenty-one million out of 207 million have no access to safe drinking water. India, Ethiopia, and Nigeria are the top three nations that face problems with pure drinking water.

Pakistanis live in southern Asia, with India to their east, Afghanistan to their west, and China to their north. The Himalayan and Karakorum mountains may be found in the east of Pakistan. Hindukush Mountains may be found in the north, while hill areas (up to 4700 m) can be found in the northwest and upland Baluchistan plateau. The climate in different parts of Pakistan is primarily dry to semiarid, with varied degrees of average rainfall (Daud et al., 2017). The Indus is Pakistan's most important river, running from the Karakorum Mountains to the Arabian Sea. Nature has provided Pakistan with rich surface and groundwater resources. Industrialization development and fast population increase water supplies in a highly strained position. Water is necessary for our survival in many aspects, including the growth and development of the country. It has a significant impact on every aspect of our lives. Drinking water may have a variety of physical, biological, and chemical contaminants due to technological advancements (Romshoo et al., 2020).

Water contamination is a cycle that occurs because of anthropogenic movement in different water assets like lakes, groundwater, and streams. Using contaminated water can spread waterborne diseases; as per the local area well-being overview, using unfortunate and polluted water causes illnesses in about 40 percent of mortalities in Pakistan. In Khyber Pakhtunkhwa (KP), about 80 percent of the population's admittance to unmodified water from ground sources and surfaces. Surface water assets in KP are unblemished and protected to drink, but groundwater in the south is blackish in variety. In the understanding, there is likewise perfect water.

Nevertheless, groundwater is abundant and frequently used along with cylinder wells in the core of KP. Surface water and springs are the significant wellsprings of water in the north of KP. Due to crumbling water requiring more treatment and the absence of a purification foundation in metropolitan regions, access to adequate and quality water or safe drinking water is shallow (Gorelick & Zheng, 2015).

The Mardan district might be divided into two regions: a rocky territory in the north and a plain in the south. The different rivers, i.e., the Kabul River, joined the area, like Banzai and the Kalpani, and the critical steam was used for water. They also used sources like wells, streams, and water storage tanks. The following are the primary drinking water sources in Mardan. Water is now supplied to the inhabitants of Mardan district by 22 tube wells and 11 overhead reservoirs; however, owing to a lack of distribution network, several areas still need to be subserviced. Tube wells are used to provide drinking water. Domestic wells, open wells, and shallow Tube wells provide drinking water. The locals utilize open wells, shallow wells, residential boreholes, hand pumps, and other methods. In the operational zones, water is delivered in three shifts of three to four hours daily (Khan, 2011).

Access to clean, safe drinking water has been proclaimed a fundamental human right and an essential step toward improving living conditions worldwide by the United Nations and other governments. Water access was one of the UN's Millennium Development Goals and remains one of the UN's Sustainable Development Goals. Following the 1998 National Water Act, the South African constitution proclaims "access to water and food for everyone" as the primary goal. Despite these facts, there are significant inequities in access to clean drinking water in South Africa and across the world, with people experiencing poverty and women and children bearing the brunt of the problem. Inequalities exist both inside and across nations. For example, the population that lacks access to water and sanitation is ethically reprehensible, but it is illegal under international law (Leton & Wright, 2004).

More than just the coverage of drinking water from improved sources is needed in rural areas throughout developing countries. From 1990 to 2004, metropolitan drinking water inclusion

stayed consistent at 95%, while rustic inclusion expanded in 1990, i.e., 64 percent, and in 2004, 73 percent, respectively (Wanda, et al., 2017). Around 5.2 billion individuals have to consume available safe drinking water. In contrast, the excess of 2.2 billion people lacks quality water, i.e., 1.4 billion individuals living away on about 30 30-minute journeys to find pure drinking water with basic service. Meanwhile, 206 million people had 30 minutes trip to find clean drinking water. About 144 million people collect untreated surface water from ponds, lakes, streams, and springs. And about 144 billion persons gather untreated surface water from lakes, springs, and streams (Hutton et al., 2004). More than 40% of the total populace is impacted by water lack, a disturbing dimension that is supposed to climb as worldwide temperatures climb because of environmental change. Furthermore, in all continents, the availability of clean drinking water has declined every passing day (Wheeler & Von, 2013).

Access to clean and safe drinking water is a fundamental human need and plays a crucial part in the community. According to a recent World Bank report, Pakistan is ranked 140th out of 180 countries on the water and sanitation environmental index, with 64 percent of Pakistanis without access to clean drinking water. Similarly, Mardan, Pakistan's second-largest city, has a water shortage. Drinking contaminated water causes a variety of illnesses, including diarrhea, dysentery, typhoid, and hepatitis. These illnesses can potentially reduce human productivity, and curing them will require significant money. As a result, drinking clean water is highly advised for people's health and population production. They must guarantee that our people have access to safe and clean water. This research aims to discover issues with delivering water quality and the significance of the harmful effect of polluted water on health. Seeing its importance, the present study was arranged in District Mardan to investigate issues related to clean drinking water in the research area and problems and constraints rural communities face in drinking water in the research area.

Methodology

The Mardan District is the Universe of the Study. The Mardan district latitude is 71° 48' and 72° 25' east, and longitudes 34° 05' to 34° 32' north is situated. Its eastern and northern boundaries are connected by the district Buner and the protected areas of Malakand. However, its southern and western boundaries are touched by Malakand and District Charsadda. The district includes a total area of 1632 km2. As of 2017, 2,373,061 people are living in the Mardan district. Lack of clean drinking water was a significant problem in the research area. District Mardan was chosen as the study's sample population for these purposes.

Khyber Pakhtunkhwa comprises 33 districts. District Mardan was chosen purposely on the basis of more cases. Mardan District comprises of 03 Tehsils i.e Takht Bhai, Katlang and Mardan. Tehsil Takht Bhai was selected randomly for the present study. Two villages, Lund Khwar, and Parkho Kali, were purposively selected from Tehsil Takht Bhai. The total household of these two villages is 1190. Yamani formula was used to fix the sample to 299, and through proportional allocation methodology, 299 was distributed among the two villages, whose details are given below in table 1.

Table 1: Sampling Distribution in the Study Area

Name of Village	House Hold Population	Sampled Population
Lund Khwar	570	143
Parkho Kali	620	156
Total	1190	299

The data was consisted of primary and secondary. Through face to face interview schedule the primary data was collected from households of the selected villages of Mardan district. The

interview schedule was written in English language but the questions were asked in local Pashto language to make the respondents understand and obtain relevant and accurate information to find out data according to study objectives.

The present study consist of both quantitative and qualitative data, for data analysis a SPSS, was used in order to get the accurate result to meet the research objectives. For association purpose, Chi square was applied.

Chi Square formula is: $\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$ Where

E_i is the expected frequencies

O_i is the observed frequencies

Table 2: Expected Sign of Independent and Dependent Variable

Independent Variable	Dependent Variable	Expected Sign
Rusted pipes	Water Quality	+-
Water borne disease	Water Quality	+-
Industrial waste material	Water Quality	+-
Air pollution	Water Quality	+-
Chlorination	Water Quality	+-
Septic tank	Water Quality	+-
Open sewerage system	Water Quality	+-
Water drain system	Water Quality	+-
Low water pressure	Water Quality	+-
Low income	Water Quality	+-

Table 3: Conceptual Framework of the Association of independent Variables and Dependent Variable

Independent Variable	Dependent Variable
Rusted pipes	Quality of Water
Water borne disease	
Industrial waste material	
Air pollution	
Chlorination	
Septic tank	
Open sewerage system	
Water drain system	
Low water pressure	
Low income	

Results and Discussion

This section briefly makes sense of possible results of the analysis, i.e. descriptive as well as inferential outcome as per the specific objective of the present study in the research area. These include age, literacy level, family type and occupation etc.

i. General characteristics of sampled respondents

ii. Age wise distribution of sampled respondents in the study area

Age is a basic feature which paly a very important role in human life. With the passage of time the increase, the awareness of a person will boost. The responsibility of an individual and his age has direct relationship while at elder ages an individual become wise and learn taking advantages of the available opportunities and resources.

In table 4 indicates age wise distribution of sampled respondents in the research area. The finding of the study revealed that maximum number of respondents belong to the age group of 41-50 that is 46.79 percent, while minimum number 9.61 percent of the respondents belong to the age group of 30-40 years. Village wise distribution shows that, in Lund-khwar village 45.45 percent of the respondents belong to the age group of 41-50, while 34.26 percent were from 30-40 and 20.27 percent of the respondents above 50 years. Moreover, in village Parkho Kali out of total 46.79 percent belong to age group of 41-50, while 43.58 percent of the respondents having above 50 age group and 9.46 percent from 30-40 age group.

Table 4: Age wise distribution of sampled respondents in the study area

Villages	Age group			
	30-40	**41-50**	**Above 50**	**Total Respondents**
Lund Khwar	49 (34.26)	65 (45.45)	29 (20.27)	143 (47.82)
Parkho Kali	15 (9.61)	73 (46.79)	68 (43.58)	156 (52.18)
Total	64 (21.40)	138 (46.15)	97 (32.44)	299 (100)

Education of Sampled Respondents in the Study Area

Education is the basic need of human life, which is the transfer of knowledge from one person to another. The important factor for the development of person and a whole nation is totally depending on the level of education. It's the knowledge which come from education and through this knowledge the human being made this soil paradise like constriction of high building and fly with seconds form one part of the world to another and every field of life they developed for themselves i.e agriculture, science, technology and health etc (Glaser, 1984).

Table 5 shows the distribution of sampled respondents about literacy in the research area. Sampled respondents in descriptive analysis show the education level. Descriptive analysis shows literacy level of the sampled respondents. Household were divided according to literacy levels, literate and illiterate.in the conclusion 46 percent of the respondents were illiterate while, 54 percent were literate. In village Lund-Khwar out of total 22 percent were literate and 25 percent were illiterate, however in village Parkho Kali 32 percent were literate and 21 percent were illiterate while in grass total 54 percent was literate and 46 percent were illiterate. Education play great role in the country development and without education the development of the village is impossible. So it is necessary for the government to uplift the education of the study area. Educated community know how to keep the water safe from the disease and through this way they decrease the trend level of the disease in the study area.

Table 5: Literacy status of the sampled respondents in the study area

Villages	Literate		Illiterate		Total Respondents
	No.	**%**	**No.**	%	
Lund Khwar	67	(22)	75	25	143 (47)
Parkho Kali	95	(32)	61	(21)	156 (53)
Total	162	(54)	136	(46)	299 (100)

Occupation of the Sampled Respondents

Table 6 indicates that 30 percent respondents belong to government servants and 48 percent self-employed while 22 percent belong to other services. However, in village wise distribution table shows that in Lund-khwar 6 percent belong to government servant and 28 percent self-employ while 14 percent with other occupation. Similarly in village Parkho Kali 24 percent respondents are government servant and 20 percent belong to self-employment while 8 percent belong to other profession. Occupation play great role in the socioeconomic condition of the

study area. Skill person get more wages than the non-skill person and more income is also related with safe drinking water. The person whose income is more they also purchased filter which play great role in safe drinking water. The safe drinking water protects the community from different diseases which are present in the study area water.

Table 6: Distribution of sampled respondents with respect to occupation

Village	Occupation						Total	
	Govt.		Self-Employ		Other			
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Lund khwar	17	6	85	28	41	14	143	48
Parkho Kali	73	24	60	20	23	8	156	52
Total	90	30	145	48	64	22	299	(100)

Enough Supply of Daily Water

Daily water availability is very necessary and its uses as per capita are essential to fulfill the need of the community. In rural areas, water is limited due to rural problems. There is a shortage of water in Pakistan as like United States of America, China and other part of the world. Table 7 shows the dissemination of the sampled respondents on the source of enough water supplies to fulfill daily requirement of the research area. The table shows that 71 percent of the respondents were agree and satisfied to this question while 29 percent were answer no to this question in both villages. However, in village Lund Khwar 34 percent told that the water requirement is satisfactory but 14 percent respondents' were not satisfied with the water supply in this village. Similarly in village Parkho Kali 37 percent were satisfied from the water supplies requirement while 15 percent were not satisfied from the water supply requirement. Water play great role in the development of a country. This is the water through which we irrigate the plants and this is water which is used for drinking water and without water the survival of life is impossible. The polluted water supply the germs to human and affect the body of rural community which affect their daily function and income level and affect the safe drinking water in the study area

Table 7: Distribution of the sampled respondents on the basis of enough water supply to fulfill daily requirement in the study area

Name of Villages	Yes	No	Total
Lund khwar	101 (34)	42 (14)	143 (48)
Parkho Kali	111 (37)	45 (15)	156 (52)
Total	212(71)	87(29)	299(100)

Sources of Drinking Water

Table 8 shows the distribution of sources of drinking water of the sampled respondents in the research area. According to above table out of 299 seventy three percent told that they have pipe water supply while 27 percent claimed that they have the facility of well boor in their houses. As Village wise distribution in Lund khwar only 33 percent reported the pipe water supply and 15 percent well boor while in the whole Lund khwar the percentage is 48 percent. Similarly in Parkho Kali the pipe water claim is 40 percent but the well boor facility is 12 percent and the whole is 52 percent. The discussion shows that still pipe water supply is not available due to some reason. The main reason is the income level. Those whose income is more they have availability of the pipe water. So it is the duty of the government to provide water on free basis to the study area community because safe water has great role in disease control in the study area.

Table 8: Distribution of sources of drinking water of the sampled respondents in the research area.

Village	Pipe water supply	Protected well/boor	Total
Lund khwar	99 (33)	44 (15)	143 (48)
Parkho Kali	119 (40)	37 (12)	156 (52)
Total	218 (73)	81 (27)	299 (100)

Source: Field Survey, 2021.

Treatment of Water to make it Safe for Drinking

Table 9 indicates the treatment distribution of the sampled respondents for safe drinking water in the study area. The table shows that 5 percent use the filtering water, 19 percent told that they used boiling water and 68 percent claimed for covering water while 8 percent respondents use other sources for safe drinking water.

As village wise distribution in Lund Khwar 5 percent use filter water, 8 percent boiling water, covering water 31 percent while other coverage is 4 percent. Similarly in Parkho Kali no one use the filtering water, 11 percent boiling water, 37 percent respondents use the covering water while 8 percent use other way for safe drinking water. The discussion shows that due to income level the filtering percentage is less than the other ways. The highest percentage is the covering water and the average is boiling water. So it is necessary for the government to provide filters on free basis to respondents for safe drinking water in the study area. All ways are linked with the income level. The richer mostly use the filters while the poor use the boiling water for safe drinking water. So there the big issue is the income level of the respondent. So for this issue, solution is necessary by the government to give education and skill for raising their wages for enhancement of income level.

Table 9: Treatment distributions of sampled respondents for safe drinking water in the study area

Villages	Filtering		Boiling		Covering		Other		Total	
	F	%	F	%	F	%	F	%	F	%
Lund Khwar	15	5	23	8	94	31	11	4	143	48
Parkho Kali	0	0.0	32	11	112	37	12	4	156	52
Total	15	5	55	19	206	68	23	8	299	100

Distribution of Cleaning of Water Container of the Sampled Respondents in the Research Area

Table 10 shows the distribution of cleaning drinking water container, and about 4 percent households clean water container once a week, 60 percent respondents clean the water container in a month, 11 percent once a year while 13 percent never clean the water container for safe drinking water. As village wise in Lund Khwar 2 percent respondents clean the water container in a week, 28 percent in a month and 11 percent in a year while 7 percent never clean the water container. Similarly in Parkho Kali 2 percent respondent clean the water container in a week, 32 percent in a month, 12 percent in a year while 6 percent never cleans the water container. Cleaning of water container is necessary for safe drinking water but the respondents who do not clean the water container. They have no importance about cleaning the container, so there the chances of disease is more and the people mostly affected due to water born disease. Water container cleaning is important for protection of health.

Table 10: Distribution of Cleaning of Drinking Water Container of the Sampled Respondents in the Research Area

Villages	Once a Week		Once a Month		Once a Year		Never		Total	
Lund Khwar	6	2	84	28	33	11	20	7	143	48
Parkho Kali	6	2	95	32	35	12	20	6	156	52
Total	12	4	179	60	68	23	40	13	299	100

Distribution of Sampled Respondents Perception Regarding water Quality

Table 11 shows the distribution of sampled respondents' perception regarding water quality in the study area. According to table 58 percent told that the water quality in the study area is satisfactory but 42 percent claimed that the water quality is not a satisfactory. As village wise in Lund Khwar 27 percent told that the water quality is satisfactory while 21 percent respondents say that the water quality is not satisfactory. In Parkho Kali 31 percent claimed that the water quality is satisfactory while 21 percent reported that the water quality is not satisfactory for drinking. The discussion explained that majority respondents of the study area are satisfactory which is 58% while 42 percent are not satisfactory. So it is necessary for the government to survey the area and check the situation what factors are responsible for satisfaction of water and adjust a strategy for solution of water issue.

Table 11: Distribution of sampled respondents perception regarding water quality in the study area

Name of Villages	Yes	%	No.	%	Total Respondents
Lund Khwar	81	(27)	62	(21)	143(48)
Parkho Kali	94	(31)	62	(21)	156(52)
Total	186	(58)	124	(42)	299 (100)

Source: Field Survey, 2021.

Distribution of Water Pollution Caused Disease

Table 12 shows the distribution of water pollution caused diseased in sampled respondent in the study area. According to table 55 percent respondents told that the main reason of the diseases is polluted water in the study area while 45 percent told that the causes not only pollute the water but also other factors are responsible for diseases injection in human in the study area. However, village wise in Lund khwar 28 percent respondents claimed that polluted water is the main cause of the disease injection in the study area while 20 percent go against the saying. They told that there also other factors which cause the disease in the sampled respondents. The well-known water borne diseases are malaria, diarrhea, TBB, Pain in stomach etc. These diseases spread through water in the world as well as in the study area. Butt et al (2020) investigated that microbial contamination was found in few samples where water borne diseases namely cholera, diarrhea, typhoid hepatitis A and E etc. were found. The study confirmed that most of drinking sources were affected by bacterial contamination which injects infections disease among children. Water pollution is the main cause of the mentioned disease multiplication. Presently these diseases also observed in the study area.

Table 12: Distribution of water pollution caused diseased in sampled respondent in the study area

Name of Villages	Yes	%	No	%	Total Respondents
Lund Khwar	85	(28)	58	(20)	143(48)
Parkho Kali	80	(27)	76	(25)	156(52)
Total	165	(55)	134	(45)	299 (100)

Reasons of Water Pollution in the Study Area

However, several reasons like Pesticides, insecticide, industrial effluents, deforestation, sewerage and many others were specified in to overcome the objective in the research area. In table 13 indicates the reasons of water pollution of the sampled respondents in the study area. It's shows that 2 percent respondents told that pesticides and insecticide spray on crops is responsible for pollution of water. Similarly, 5 percent of water pollution through industrial effluents and 15 percent with deforestation i.e. Through rain the material flow to river which go to water table and also mixed with the crops residual while later on mixed with drinking water and make water polluted and 23 percent of water polluted through sewage, while 3 percent of water polluted or unhygienic due to other ways in the study area.

Table 13: Reason of water pollution of the sampled respondents in the research area

Village	Pesticides and insecticide		Industrial effluents		Deforestation		Sewage		Any other specify		Total
Lund Khwar	6	2	17	5	45	15	67	23	8	3	143(48)
Parkho Kali	41	14	31	10	0	0	79	26	5	2	156(52)
Total	47	16	48	15	45	15	146	49	13	5	299(100)

Diseases Caused by Polluted Water in the Study Area

It's very important to know about the essential information regarding polluted water diseases in the study area. As we know that some disease are caused by micro-organisms while some disease are caused by physically and chemically polluted water. Table 14 Indicates that most common disease caused by polluted water is Diarrhea was the maximum in numbers, 50.34 percent in Lund-khwar and 59.61 percent in Perkhu-Deheri. Hepatitis was mentioned 11.88 percent and 5.76 percent in both villages respectively. The Typhoid was recorded 6.99 percent in Lund-Khwar and 5.12 percent in Perkhu-Kali in the study area. Lin et al (June,2022) investigated that water pollution affect the quality of water and after drinking it create the diseases of diarrhea which affect the health of the human being while aquatic environment play great role in the multiplication of Diarrhea. So, it is necessary for the government to keep the area clean for controlling of different disease. More polluted water is not cleaned which enter into the river and multiply different disease in the area. Among these diseases diarrhea, is the well-known disease which have killed so many child in the study area.

Table 14: Distribution of the sampled respondents on the basis of polluted water caused disease in the study area

Villages	Typhoid		Hepatitis		Diarrhea		Other		Total	
Lund Khwar	10	3	17	6	72	24	44	15	191	48
Perkhuklay	8	3	9	3	93	31	46	15	208	52
Total	18	6	26	9	165	55	90	30	399	(100)

Association between Different Variables

Table 13 indicates the association of independent variables with dependent variable of the sampled respondents in the study area. The rusted pipes association with quality of water is positives at .05 percent confidence level and is highly significant. The rusted pipes increase the water quality polluted which flow rusted material in the drinking water, however it affects health negatively of the people and affect their socioeconomic conditions. The below given link explain that so many things which are made of iron, steel, coppers etc. The corrosion of these material mixed with the water which mix in water and pollute the consumer food items which in the long run create multiple diseases in the human and affect their health however affect their socioeconomic conditions of the human and animal. Similar situation is also present in the study area (Paragon website, 2024).

Water borne diseases association with quality of water is insignificant at .05 confidence interval level and so it shows that water borne diseases are present in the project area but its trend is less in the study area. Butt et al. (2020) investigated that microbial contamination was found in few samples where water borne diseases namely cholera, diarrhea, typhoid hepatitis A and E etc. were found. The study confirmed that most of drinking sources were affected by bacterial contamination which injects infections disease among children. Similar situation was also observed in the present study while it was non-significant.

Industrial waste material association is significant at .05 percent confidence level. In the project area the number of brick industries are more which spread the smoke in the area which affect the water quality negatively, however it latter on affect the health of the people and increase the illness. The below link confirmed that most water contaminated by industrial waste material. The industrial material copper, chemical, iron entered through drainage system into river which irrigate the fruits of vegetables and cereal crops which are used by human while latter on it inject the diseases in the human body and affect their health. The flow water also through crack entered into the ground water, which affect badly the drinking water of the area. Similar situation was also observed in tehsil Thakhth Bai. All industrial waste material flow into river and stream which are latter on used by animal and human which inject different diseases in them however it affect their health (H20 website, 2024).

Similarly air pollution association with quality of water is also highly significant at .05 percent level. The air polluted by smoke of vehicles which latter entered into uncovered water tank which pollute the drinking water of the sampled respondent in the study area and affect their socioeconomic conditions. Kjellstrom et al. (2006) told that air is polluted by different ways namely smoking, industries, wind and nuclear station which affect the drinking water quality badly while latter on affect the health of the human. Throat, respiratory and stomach disease are multiplied in the world through air pollution.

Chlorination association with quality of water is non-significant at five percent level. It shows that there in the project area the chlorination association is weak. Peter et al. (2023) explained that diarrhea trend was more in the village where water was chlorinated by government than the non-chlorinated water and weak quality water village. It shows that Chlorinated water has no effect on the diarrhea disease control. Similar condition was also observed in the project area because there no chlorination system was present but the number of diarrhea disease was zero.

Similarly, Septic tank, play great role in the clean drinking water quality it has non-significant association with the quality of drinking water in the study area. These systems keep the waste material in the bottom of tank, and decompose the waste material by bacteria and the top water is discharged by pipe and flow to ground field and germs are killed by soil. The link below explained that septic tank should construct away the well because it makes the underground water polluted which is not suitable for drinking water because it multiply disease in the human and animal (EPA, 2024).

Open Sewerage system with quality of water was positive association and highly significant at 5% confidence level. Anwar et al. (2012) investigated that safe sewerage and clean environment and sanitation is required for the sustainable environmental condition for reduction of Diarrhea, malaria, trachoma and hepatitis A and B and morbidity level. Water drain system expels the water from the house area and reduces the chances of malaria which is caused by mosquito. The drain system and quality of water association is non-significant and people have no knowledge about its role. The link below shows that good drainage systems play a great role in providing clean drinking water. No germs were found there, and the water easily flows from the premises of the houses and keeps the environment clean, which plays a great role in health status (Susdrain, 2024).

Low water pressure association with quality water was found non-significant at .05 confidence level. It shows that association with quality water is very weak and people never care of the water pressure. Low water pressure affects the cleaning process of the quality water. Okurut investigated that low water pressure has negative relationship with quality of water. The pressure when more than the water flow is very first and no waste material is left in the small pipes of water and when the water speed is low then waste material left in the pipe which in the long run pollute the quality of water**.**

However the low income association with quality of water is highly significant. The income is the main factor because without more income the improvement of quality water is impossible in the study area. Brockwell et al. (2021) argued that income and quality of water has a positive association in the Europe countries. More income countries have good water quality while low income countries had bad quality. Similar situation is also present in the study area that more income people have good quality system while low income people have low quality system. So it shows that income play great role in clean drinking water quality.

Table 15: Association of different factors with quality of water of the sampled respondents in the study area

Independent variable	Dependent variables	Chi-square value	P –value
Rusted pipes	Water Quality	35.145	.000
Water borne disease	Water Quality	3.603	.462
Industrial waste material	Water Quality	11.363	.023
Air pollution	Water Quality	39.126	.000
Chlorination	Water Quality	5.734	.220
Septic tank	Water Quality	6.959	.138
Open sewerage system	Water Quality	28.324	.005
Water drain system	Water Quality	5.093	.278
Low water pressure	Water Quality	1.584	.812
Low income	Water Quality	15.498	.004

Conclusion and Recommendations

The present study concludes that overall clean drinking water situation in the study area is satisfactory. Different types of water sources were available and majority of the people were satisfied with the current situation. In general water availability were enough although in some areas there is an issues water related as well. In some areas, due to poor condition of pipes and sewerage system in poor condition due to which water become contaminated and causes different diseases. The Chi- square results show that association between dependent variable i.e. water quality and independent variables i.e. rusted pipes, water born disease, industrial waste material, air pollution, chlorination, septic tank, open sewerage system, water drain system, low water pressure and low income. The results show air pollution, rusted piped, low

income and open sewerage system result were highly significant at .05 confidence level. However, the result for other independent variables i.e. water born disease, water drain system, low water pressure, septic tank and chlorination associations were found insignificant at .05 confidence level. The study recommends that government should facilitate rural community in provision of the clean drinking water and bring awareness regarding water related issues. The local community should made self-help to meet the challenges of the need of safe drinking water in the study area; government should facilitate rural community in provision of the clean drinking water; government should bring awareness regarding water related issues; community should made self-help to meet the challenges of the need of safe drinking water; community should be educated about these for controlling purpose.

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