Drinking Water Quality characteristics of District Nowshera after flood of 2010

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Summary

Chemical characteristics of different sources of drinking water in the badly effected district (Nowshera) of Khyber Pakhtunkhwa were studied. The physical parameter studied were color, odour, taste, turbidity, conductivity, and pH, whereas the chemical parameters include TS, TDS, TSS, Total hardness, Calcium hardness, Magnesium hardness, Alkalinity, Chlorides, Sulphates, Nitrites, Sodium, and Potassium. Samples of water were collected from different sources like tube wells, dug well, and hands pump. Most of the parameters were found much higher then the WHO permissible limits and more then 60% of samples were found unfit for drinking purpose. It was indicated that the water quality of district Nowshera has been worstly deteriorated and contaminated as a result of the flood of 2010 and certain remedial measures would be required to make the water potable for human consumption.

Introduction

Water pollution is the phenomenon that is characterized by the deterioration of the quality of land water (rivers, lakes, marshes, and ground water) or seawater as a result of various human activities (1). Water is the basic need of life. Fresh water immediately available to man for drinking, and other purposes is only 0.002% of the total water. Since

the demand for water is mostly for fresh water, and everyone have to depend mainly on this tiny fraction of the total water present on this planet. Further the uneven distribution of water on the surface of the earth makes it a scarce resource at several places. A number of diseases are caused by the consumption of poor water quality. It has been reported in the "community health study" that 50% of all reported causes of illness, and 40% of deaths in Pakistan are due to water borne diseases; the main reason is poor water quality(2).

In the Khyber PukhtoonKhwa more than 80% of the population has access to relatively clean drinking water. The sources for drinking water are both surface, and underground. In the southern part of the province, surface water resources are limited, while ground water is brackish or only available in limited quantities at greater depths. The central part of the province has greater ground water potential, and the water is pumped from tube wells with house connections. The systems in the northern parts of the K.P.K. are generally based on springs or surface water. The quantity of drinking water in the K.P.K., however, is often low due to the aging distribution system, lack of local treatment facilities, and contaminated water sources in some parts of urban centers(3). Potable water quality of well water in the urban areas of Peshawar have been studied(4), which reveals that magnesium content in well water is higher than the WHO permissible limit. Chemical characteristics of subsurface water of Haripur area of Hazara were also studied(5), which indicate that the potable water of Haripur area is contaminated due to the presence of Nitrites. Quality characteristics of potable water from district Bannu were also studied(6), which indicate that the dug-well, bore-well and shallow-well water are unfit for drinking purpose. Studies on the monitoring of the potable water of NWFP have also been carried out(7). Water quality characteristics of Kabul river (Pakistan) under low and high flow conditions were also studied(8 & 9).

80% of Nowshera district has been badly affected by the current devastative flood and torrential rains. 40% houses, animals, household items and other belongings were swept away by heavy flood in Nowshera. Around 10000 houses were totally destroyed while about 40,000 were damaged. The badly affected areas are Mohib Banda, Dheri Mian

Ishaq, Tetaray, Khush Maqam, Jabba, Nowshera Kalan, Zakhel Payan, Bara Banda, Amankot, Hakeem Abad, and Dag Besood. In these areas, the houses of people were either completed destroyed or damaged partially and people are living under the open sky looking for relief. The government organizations and relief agencies are trying their best to provide relief to the affectees but devastation in these areas are so big that could not full fill the needs of such large number of populations. The people of worst affected Mohib Banda and Dheri Ishaq were traumatized by the record breaking floods as they left homes at evening to avoid flood following last night heavy rain and return homes at morning for sake of assistance.

The presence studies are aimed to evaluate the drinking water of district Nowshera after flood and their possible remedial measure and recommendation to make the water potable.

Results and Discussion

The color, odour and taste of the samples collected from dug well, bore well and hands pump are somewhat objectionable whereas the tube well water are colorless, tasteless, and odourless. Most of the sample collected from hand pumps, bore well and dug well are turbid whereas the tube well water is clear. The conductivity of the samples collected from hand pumps, dug well, and bore well, is some what higher then the WHO limits. The pH of almost all the samples lies within the permissible WHO limits. The results are shown in table 2.

Table: 2. Physical Parameter (color, odour, taste, turbidity, conductivity, pH)

S.No.	Color	Odour	Taste	Turbidity	Conductivity	pH
1	Colorless	Smelly	Light Pungent	Turbid	1625	7.80

2	Colorless	Smelly	Tasteless	Turbid	2030	7.20
3	Colorless	Odourless	Tasteless	Clear	825	7.50
4	Colorless	Odourless	Tasteless	Turbid	1830	7.15
6	Milky	Smelly	Pungent	Turbid	3250	8.5
7	Colorless	Odourless	Tasteless	Clear	715	7.35
8	Brownish	Smelly	Pungent	Turbid	2780	8.6
9	Colorless	Odourless	Tasteless	Clear	730	7.20
10	Colorless	Odourless	Tasteless	Clear	680	7.60
11	Brownish	Smelly	Pungent	Turbid	3250	8.7
12	Colorless	Odourless	Tasteless	Clear	530	7.30

Similarly the TS, TDS and TSS contents of water samples collected from hand pumps, dug wells and bore well are higher than the WHO limits whereas these parameters for tube well water lie within the permissible WHO range. The total hardness, calcium and magnesium contents of the hand pumps, bore water, and dug well water are also higher than WHO limits. The results are indicated in table 3.

Table: 3. Chemical parameters (TS, TDS, TSS, hardness, Calcium, Magnesium)

S.NO.	TS mg/L	TDS mg/L	TSS mg/L	Total hardness as $CaCo_3$ (mg/L)	Calcium as $CaCo_3$ (mg/L)	Magnesium as $CaCo_3$ (mg/L)
1	1225	1210	15	560	250	310
2	880	875	5	320	215	105
3	770	760	10	410	205	205
4	940	920	20	550	320	220
5	915	910	5	360	220	140
6	1850	1820	30	680	420	260
7	780	775	5	425	305	120
8	2250	2215	35	650	330	320

9	740	737	3	380	250	130
10	790	786	4	320	200	120
11	2050	2030	20	690	380	310
12	835	831	4	280	150	130

The Alkalinity, Chloride, and Sulphate contents of the bore, hand pump and dug well water are higher than the WHO limits whereas the same lie within the permissible limit for tube well water. The Nitrite contents in almost all the samples are higher than the WHO permissible level. The sodium content in sample collected from hand pumps, bore well and dug well are higher than the WHO limit whereas the Potassium concentration in all the samples lie within the permissible level. The results of these parameters are shown in table 4.

Table:4 chemical parameter (Alkalinity, Chlorides, Sulphates, Nitrites, Sodium, Potassium)

S.No.	**Total Alkalinity as $CaCo_3$ (mg/L)**	**Chlorides as Cl^- (mg/L)**	**Sulphates as SO_4 (mg/L)**	**Nitrites as NO^-_2 (mg/L)**	**Sodium as Na^{+2} (mg/L)**	**Potassium as K^+ (mg/L)**
1	280	130	260	2.0	210	2.3

2	320	80	225	1.8	180	3.1
3	380	110	280	1.5	215	2.8
4	290	70	312	1.3	222	3.5
5	250	50	122	1.2	170	3.1
6	220	118	185	0.8	125	2.8
7	310	132	270	0.5	216	1.3
8	280	75	220	1.6	222	2.2
9	270	60	80	0.6	112	2.6
10	315	125	268	1.1	130	1.8
11	295	115	255	1.3	128	3.6
12	240	95	213	1.5	205	2.7

The WHO potable water quality standards(11) for the above mentioned parameters are given in table 5.

Table:5 Potabale Water Quality Standards Set By WHO

Physio-chemical Parameters	W.H.O. Standards
Color	Colorless
Odor	Odorless
Taste	Tasteless
pH	6.2-9.2
Conductivity	400 μs/cm3
T.S.	1000 mg/L
Chloride as Cl^{-1}	250 mg/L
Total Hardness as $CaCO_3$	500 mg/L
Total Alkalinity as $CaCO_3$	500 mg/L
Sodium as Na^{+1}	200 mg/L
Potassium as K^{+1}	75 mg/L
Nitrite NO2	0.5 mg/L
Sulphate	250 mg/L
Calcium	250 mg/L
Magnesium	150 mg/L
Total dissolved solid	1000 mg/L
Total suspended solid	5.0 mg/L

Experimental

Twelve samples were collected in clean bottles, first washed with distilled water, and then with the sample water. The pH and conductivities were determined on the spot, and for further physico-chemical analysis, the samples were brought to the laboratory.

The Areas from which the samples were collected are summarized in table-1

Table-1. Samples, Locations & Sources:

Sample NO.	Location	SOURCE
1	Akora Khattak	Dug well
2	Misribanda	Bore Well
3	Pirsabak	Tube well
4	Adamzai	Hand Pump
5	Hakimabad	Tube Well
6	Badrashi	Dug Well
7	Pirpiai	Tube Well
8	Azakhel	Bore Well
9	Pabbi	Tube Well
10.	Dagbesud	Tube well
11.	Tarujabba	Dug Well
12.	Tarnab faram	Tube Well

The pH was determined with a potable pH meter. The conductivity was measured with a potable conductivity meter (Jenway, England). The TS, TDS, TSS, hardness, Calcium,

Magnesium, Alkalinity, Chlorides, and Sulphates were determined by conventional method as referred by APHA/AWWA(10). Nitrates were determined by Sulphonilic method using a UV Spectrophotometer (Hitachi-U-2000). Sodium and Potassium were determined by Flame Photometer (Jenway-FPF-7). The color was measured with naked eye, odour by smell and taste organolaptically.

Conclusions:

From the study undertaken, it can be concluded that most of the water resources in district Nowshera have been badly contaminated as a result of the flood of 2010. The tube well water on account of its deep depth (400-500 ft) has been saved from the flood whereas the rest of the resources i.e. hand pumps, dug well, and bore well have been polluted due to flood water. The following recommendations are therefore suggested to make the water safe for human consumptions.

Recommendations

For further betterment, the following recommendations are suggested:

- Chlorination in overhead tanks should be facilitated.
- Regular cleaning of tanks should be undertaken to prevent from algal growth.
- Regular inspection of storage, and supply facility of all areas.
- Provision of pamphlets, and broachers to public about measures done for cleaning, and improving water quality.
- Proper training should be given to caretakers of storage facilities of water regarding cleaning, and supply of water to residents.
- Filters should be installed.
- Storage facilities should be improved.

- Set up more quality analysis laboratories for checking quality of drinking water.
- Old and leaked pipes should be replaced.
- For effective awareness, seminars, workshops should be arranged frequently; as well as educational institutions should be setup.

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