



WATER QUALITY OF DIFFERENT WATER SOURCES OF TEHSIL KARWI, CHITRAKOOT DISTRICT, UTTAR PRADESH

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ABSTRACT

Water is one of the most important of all natural resources known on the earth. The safety of drinking water is important for the health. The safety of drinking water is affected by various contaminants which included chemical and microbiological. Such contaminants cause serious health problems. The physico-chemical analyses of drinking water quality at Tehsil Karwi, Chitrakoot District, Uttar Pradesh, were studied. pH, total dissolved solids, total hardness have been determined along various water quality profiles. The experimental procedures were set according to the international drinking water standards set by WHO, BIS, NEER and APHA. The quality of groundwater samples was discussed with respect to these parameters and thus an attempt was made to ascertain the quality of groundwater used for drinking and cooking purposes in the sampling areas.

KEYWORDS: Groundwater, Human health, Physio-chemical parameter, Water quality.

INTRODUCTION

Many villages in Tehsil Karwi, Chitrakoot district, Uttar Pradesh, are facing water quality problem as well as drinking water shortage, especially during summer season. Adults and children of this region are suffering from health problem due to consumption of contaminated water. This paper assesses physico-chemical and drinking water quality from different water sources of Tehsil Karwi, Chitrakoot District for determining its suitability of drinking purpose.

Ground water quality depends on the quality of recharged water atmospheric precipitation inland surface water and sub-surface geochemical processes. Temporal change in the origin and constitution of the recharged water, hydrologic and human factors may cause periodic change in ground water quality. Water pollution not only affects water quality but also threatens human health, economic development and social prosperity. Ground water is a source of drinking water and even today more than half of the world population depends on ground water for survival. The assessment of water quality is very important for knowing the suitability for various purpose (Tiwari et al., 2003; Garg and Singh, 2003; Singh et al., 2011; Tiwari et al., 2014; Dixit et al., 2015; Tiwari, 2015 and Tiwari, 2016).

MATERIAL AND METHODS

Ground water samples, collected from 27 different location of Tehsil Karwi, District Chitrakoot, Uttar Pradesh from various ground water sources for winter, summer and post monsoon seasons, were analyze for physic-chemical parameters (pH, hardness, chloride, alkalinity, TDS, nitrate, Fluoride, Iron, phosphate, etc) using standard methods (NEERI, 1986; Saxena, 1990 and APHA, 1992).

RESULTS AND DISSCUTION

Total dissolves solids

The total dissolve solid during year 2013-14 (summer, rainy and winter) hand pumps, wells and bore- wells range from 382-1225, 390-1224, and 380-1200 mg/l, 640-755, 700-1360, 618-752 mg/l and bore- wells ranges from 575-640, 600-685 and 570-630 mg/l and during year 2014-15(summer, Rainy and winter) total dissolve solids ranges from Hand pumps,400-1240,380-1240 ad 375-1250 mg/l, wells 750-1090, 700-990 and 700-1000 mg/l and bore- well 570-760, 600-682 and 560-758mg/l The total solids in study area were shown in table 1, 2, 3, 4, 5, 6 and figure 1-2.

Table 1: Physico-chemical water quality of rainy season (2013-14).

S.N.	Name of sampling stations	Sources	Parameters									
			TDS (mg/l)	pH	Total hardness (mg/l)	Chloride (mg/l)	Alkalinity (mg/l)	Fluoride (mg/l)	Nitrate (mg/l)	Sulphate (mg/l)	Phosphate (mg/l)	Iron (mg/l)
1.	Dewal	Hand Pump	500.0	7.2	350.0	175.0	360.0	1.0	25.0	255.0	0.38	0.1
2.	Prasidhpur	Hand Pump	390.0	7.2	510.0	150.0	410.0	1.0	35.0	250.0	0.15	0.1
3.	Panautee	Hand Pump	430.0	7.5	255.0	150.0	310.0	0.5	25.0	330.0	0.18	0.1
4.	Hardaully	Hand Pump	1224.0	8.0	320.0	125.0	315.0	1.0	25.0	160.0	0.30	0.1
5.	Ataraully	Hand Pump	425.0	8.0	350.0	150.0	340.0	0.6	25.0	144.0	0.10	0.1
6.	Budha Semarwar	Hand Pump	480.0	7.5	510.0	75.0	305.0	0.5	35.0	80.66	0.18	0.1
7.	Sursen	Hand Pump	790.0	8.5	250.0	150.0	345.0	0.6	25.0	241.0	0.38	0.1
8.	Mahuwa	Hand Pump	580.0	8.0	345.0	125.0	365.0	1.3	35.0	286.88	0.40	0.1
9.	Parasaunja	Hand Pump	520.0	6.5	350.0	75.0	395.0	1.0	25.0	260.5	0.06	0.1
10.	Bhaganpur	Hand Pump	700.0	7.1	436.0	125.0	425.0	1.0	25.0	244.1	0.10	0.1
11.	Khamareya	Hand Pump	712.0	7.2	315.0	75.0	470.0	0.5	35.0	260.2	0.05	0.1
12.	Lookpatauda	Hand Pump	890.0	7.2	328.0	75.0	460.0	0.5	35.0	318.0	0.06	0.2
13.	Ramyapur	Hand Pump	1210.0	7.3	290.0	125.0	415.0	1.0	25.0	258.0	0.04	0.2
14.	Kucharam	Hand Pump	530.0	7.5	395.0	70.0	345.0	1.0	100.0	225.0	0.12	0.1
15.		Well	1360.0	7.5	210.0	225.0	315.0	1.0	100.0	200.0	0.14	0.1
16.	Baghauda	Hand Pump	670.0	7.2	365.0	100.0	285.0	0.5	25.0	245.8	0.08	0.1
17.		Well	700.0	7.2	240.0	325.0	325.0	1.5	45.0	130.0	0.12	0.1
18.	Padree	Hand Pump	600.0	7.2	346.0	150.0	400.0	1.0	35.0	332.0	0.18	0.2
19.		Well	712.0	7.5	670.0	500.0	318.0	1.5	35.0	217.4	0.15	0.2
20.	Bharatkoop	Hand Pump	780.0	7.5	436.0	125.0	435.0	1.0	140.0	320.0	0.45	0.1
21.		Well	980.0	7.5	350.0	175.0	335.0	1.5	45.0	80.0	0.17	0.1
22.	Pahadi	Hand Pump	1100.0	7.5	255.0	300.0	350.0	0.5	35.0	400.0	0.15	0.1
23.		Bore Well	600.0	6.0	330.0	150.0	346.0	1.5	35.0	350.0	0.18	0.1
24.	Lodhwara	Hand Pump	590.0	7.2	515.0	75.0	375.0	0.5	45.0	109.8	0.16	0.1
25.		Bore Well	656.0	7.3	225.0	100.0	339.0	1.0	45.0	240.0	0.15	0.1
26.	Karwi	Hand Pump	518.0	7.1	365.0	100.0	405.0	0.5	100.0	228.0	0.30	0.2
27.		Bore Well	685.0	7.2	225.0	100.0	358.0	1.0	100.0	260.0	0.20	0.2

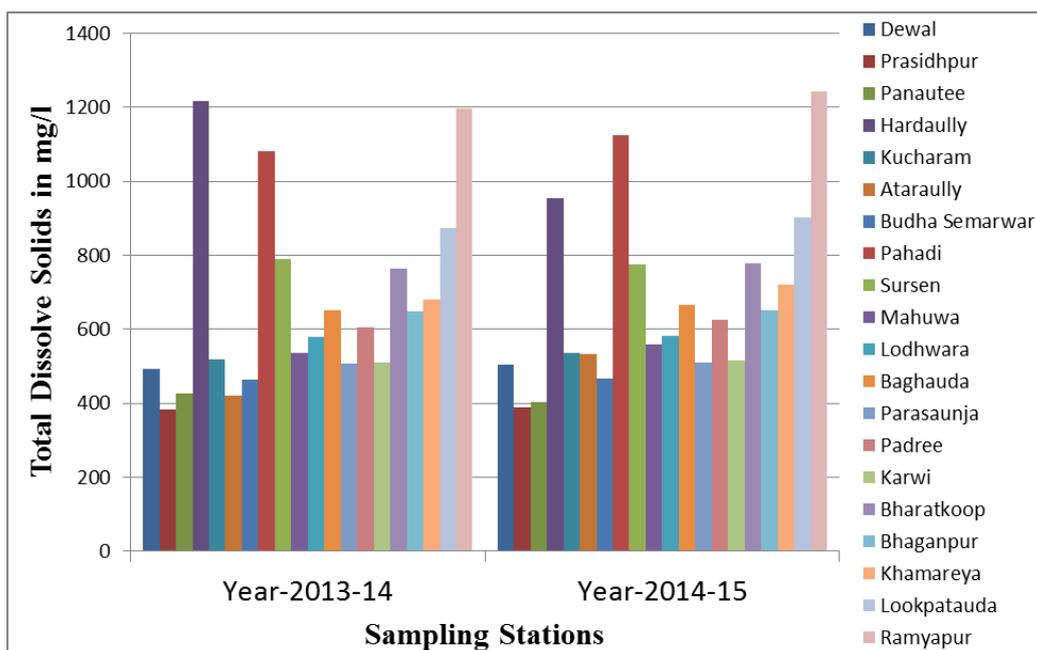


Figure 1: Average seasonal variations of TDS in hand pump water in different sampling stations.

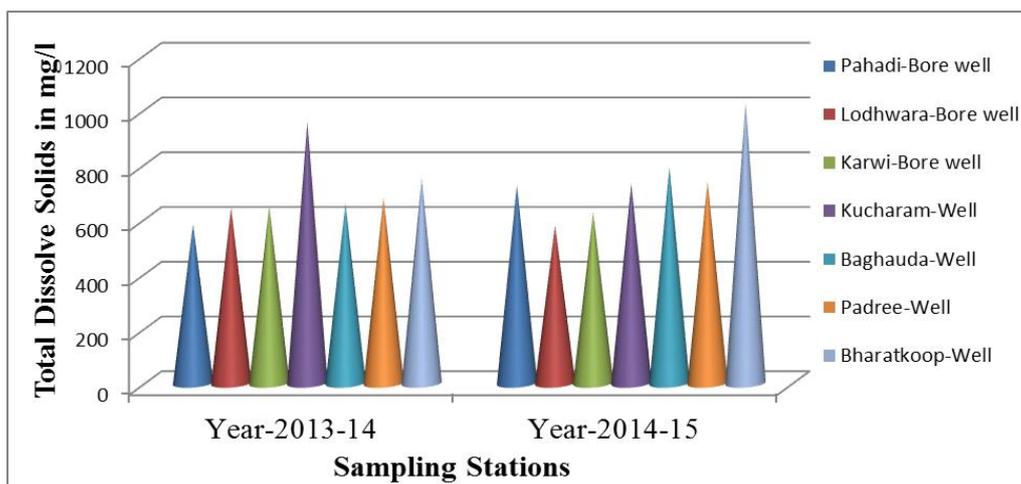


Figure 2: Average seasonal variations of TDS in bore well and well water in different sampling stations.

pH

It was one of the most important parameters in water chemistry and defined as $-\log [H^+]$, and measured as intensity of acidity or alkalinity on a scale ranging from 0-14. If free H^+ are more it is expressed. Acidic [i.e. $pH < 7$], while more OH^- ions is expressed as alkaline [i.e. $pH > 7$]. pH of ground water during year 2013-14

(summer, rainy and winter) hand pumps, wells and bore-wells ranges from 6.9-8.5, 7.1-8.5 and 6.0-8.0, 7.1, 7.2-7.5 & 6.5-7.5 and 6.5-7.2, 6.0-7.3 and 6.5-7.0 and while during year 2014-15 pH hand pumps, wells and bore-wells ranges from 6.9-8.0, 7.1-8.2, 6.5-8.1, 6.9-7.5, 7.2-7.7, 6.6-7.6 and 6.9-7.1, 7.2-7.6 and 6.6-7.1. The pH in study area is shown in table 1, 2, 3, 4, 5, 6 and figure 3-4.

Table 2: Physico-chemical water quality of winter season (2013-14)

S.N.	Name of sampling stations	Sources	Parameters									
			TDS (mg/l)	pH	Total hardness (mg/l)	Chloride (mg/l)	Alkalinity (mg/l)	Fluoride (mg/l)	Nitrate (mg/l)	Sulphate (mg/l)	Phosphate (mg/l)	Iron (mg/l)
1.	Dewal	Hand Pump	492.0	6.5	345.0	75.0	346.0	1.0	10.0	250.0	0.25	0.1
2.	Prasidhpur	Hand Pump	380.0	6.8	480.0	75.0	400.0	1.2	25.0	240.0	0.12	0.1
3.	Panautee	Hand Pump	420.0	6.9	214.0	176.96	290.0	1.2	25.0	320.0	0.15	0.0
4.	Hardaully	Hand Pump	1200.0	7.5	300.0	160.0	300.0	0.5	15.0	190.0	0.25	0.1
5.	Ataraully	Hand Pump	415.0	7.5	250.0	170.0	332.0	0.5	15.0	164.0	0.08	0.0
6.	Budha Semarwar	Hand Pump	450.0	7.2	328.0	60.0	295.0	0.6	25.0	100.6	0.20	0.1
7.	Sursen	Hand Pump	785.0	8.0	200.0	200.0	330.0	0.5	20.0	250.0	0.30	0.1
8.	Mahuwa	Hand Pump	510.0	7.5	300.0	150.0	342.0	1.0	25.0	280.88	0.35	0.0
9.	Parasaunja	Hand Pump	490.0	6.0	330.0	125.0	378.0	1.5	25.0	250.5	0.08	0.1
10.	Bhaganpur	Hand Pump	618.0	6.9	401.0	162.0	406.0	1.0	25.0	254.1	0.08	0.1
11.	Khamareya	Hand Pump	660.0	6.6	270.0	75.0	450.0	1.0	35.0	270.2	0.05	0.1
12.	Lookpatauda	Hand Pump	858.0	6.5	285.0	85.0	345.0	1.0	35.0	328.0	0.08	0.1
13.	Ramyapur	Hand Pump	1180.0	6.0	255.0	150.0	388.0	1.0	10.0	268.0	0.04	0.2
14.	Kucharam	Hand Pump	510.0	7.0	360.0	80.0	330.0	0.7	100.0	245.0	0.10	0.1
15.		Well	752.0	7.0	150.0	250.0	290.0	1.0	100.0	220.0	0.12	0.1
16.	Baghauda	Hand Pump	630.0	6.5	480.0	125.0	245.0	0.5	25.0	265.0	0.07	0.1
17.		Well	618.0	6.5	225.0	375.0	300.0	1.0	45.0	150.0	0.10	0.1
18.	Padree	Hand Pump	600.0	6.6	325.0	180.0	390.0	1.0	35.0	342.0	0.16	0.2
19.		Well	650.0	7.5	600.0	450.0	300.0	1.0	45.0	218.0	0.12	0.1
20.	Bharatkoop	Hand Pump	752.0	7.0	4500	150.0	428.0	1.5	35.0	310.0	0.20	0.1
21.		Well	630.0	7.0	270.0	150.0	315.0	1.5	45.0	90.0	0.14	0.1
22.	Pahadi	Hand Pump	1060.0	7.0	345.0	325.0	342.0	1.0	25.0	410.0	0.12	0.1
23.		Bore Well	570.0	6.5	330.0	100.0	330.0	1.0	35.0	340.0	0.15	0.1
24.	Lodhwara	Hand Pump	570.0	6.8	330.0	100.0	355.0	1.0	45.0	120.0	0.14	0.1
25.		Bore Well	630.0	7.0	150.0	50.0	332.0	1.0	10.0	260.0	0.12	0.1
26.	Karwi	Hand Pump	500.0	6.7	330.0	75.0	390.0	0.5	100.0	238.0	0.25	0.2
27.		Bore Well	618.0	6.5	210.0	75.0	345.0	1.0	50.0	270.0	0.16	0.2

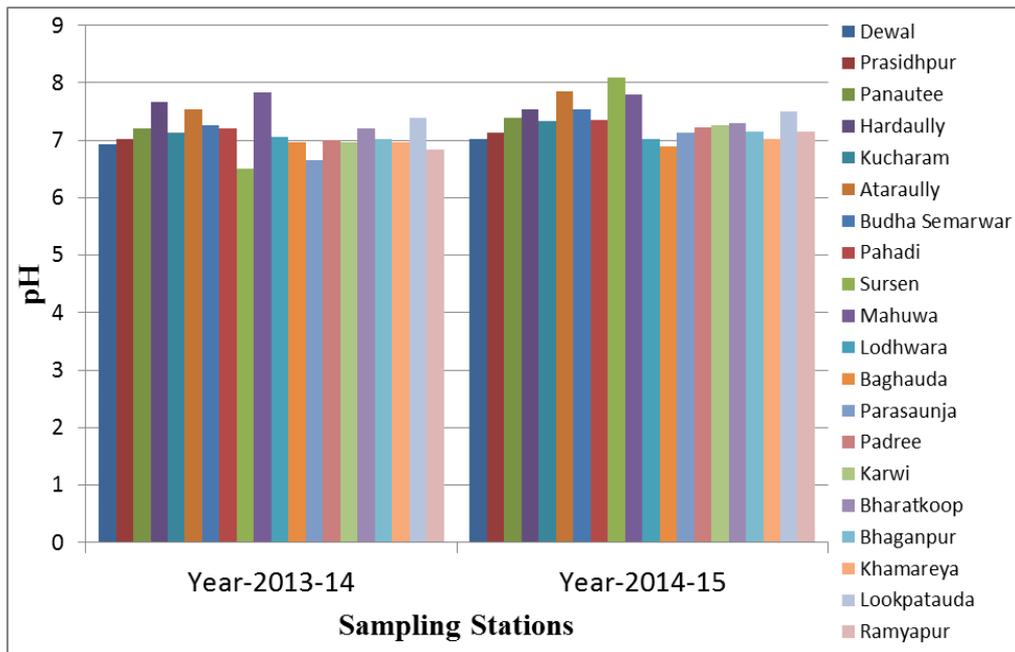


Figure 3: Average pH value in hand pump water in different sampling stations.

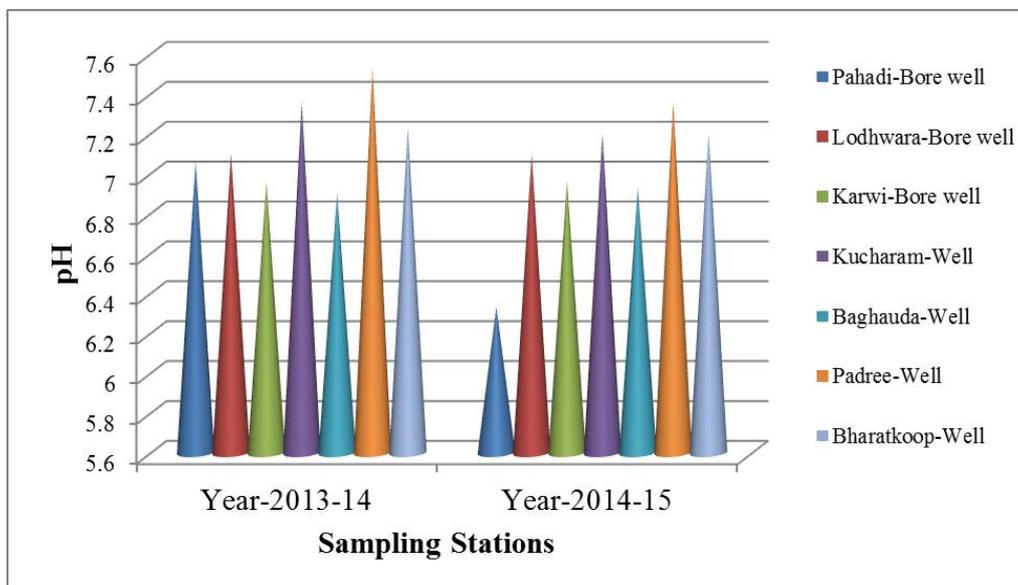


Figure 4: Average pH value in bore well and well water in different sampling stations.

Total hardness as CaCO₃

Water hardness was the traditional measure of the capacity of water to react with soap, soap is precipitated chiefly by the calcium and magnesium iron present. The total hardness of ground water year 2013-14(summer, rainy, winter) ranges from hand pumps 120-570, 250-510 and 210-400 mg/l, wells 375-675, 210-670 and 150-600 mg/l and bore- wells 225-390,225-330, and 150-330 mg/l, and during year 2014-15 ranges from handpumps 155-510,240-510, and 260-475 mg/l wells, 250-455,260-570 and 250-450 and bore-well-210-385,255-340, and 200-375 mg/l. Hardness value for all hand-pumps, wells and bore-wells is with the WHO acceptable limit. Hardness of Padree well in average value of 550 mg/l. These values are near about of last acceptable limit of WHO (300-600 mg/l.) Exposure to hard water has been

suggested to be a risk. Factor that could exacerbate eczema. The total hardness ground water sampling stations are presented in table 1, 2, 3, 4, 5, 6 and figure 5-6.

Table 3: Physico-chemical water quality of summer season (2013-14)

S.N.	Name of sampling stations	Sources	Parameters									
			TDS (mg/l)	pH	Total hardness (mg/l)	Chloride (mg/l)	Alkalinity (mg/l)	Fluoride (mg/l)	Nitrate (mg/l)	Sulphate (mg/l)	Phosphate (mg/l)	Iron (mg/l)
1.	Dewal	Hand Pump	490.0	7.1	330.0	125.0	340.0	1.0	25.0	252.0	0.30	0.2
2.	Prasidhpur	Hand Pump	382.0	7.1	500.0	125.0	398.0	1.2	10.0	245.0	0.10	0.2
3.	Panautee	Hand Pump	425.0	7.2	405.0	125.0	292.0	0.5	10.0	310.0	0.10	0.2
4.	Hardaully	Hand Pump	1225.0	7.5	300.0	150.0	340.0	1.0	35.0	200.0	0.30	0.2
5.	Ataraully	Hand Pump	425.0	7.1	375.0	100.0	330.0	0.5	45.0	170.0	0.05	0.2
6.	Budha Semarwar	Hand Pump	460.0	7.1	570.0	275.0	300.0	1.0	25.0	100.0	0.18	0.2
7.	Sursen	Hand Pump	790.0	8.0	300.0	75.0	340.0	0.5	10.0	240.0	0.28	0.2
8.	Mahuwa	Hand Pump	520.0	8.0	375.0	150.0	340.0	1.0	25.0	290.8	0.36	0.2
9.	Parasaunja	Hand Pump	510.0	7.5	300.0	200.0	382.0	1.0	10.0	240.5	0.10	0.1
10.	Bhaganpur	Hand Pump	629.0	7.1	525.0	125.0	416.0	0.5	25.0	260.0	0.10	0.2
11.	Khamareya	Hand Pump	665.0	7.1	270.0	75.0	460.0	0.5	35.0	270.0	0.06	0.1
12.	Lookpatauda	Hand Pump	868.0	8.5	120.0	100.0	355.0	1.5	10.0	326.0	0.09	0.3
13.	Ramyapur	Hand Pump	1200.0	7.2	270.0	100.0	400.0	0.5	35.0	267.0	0.06	0.1
14.	Kucharam	Hand Pump	515.0	6.9	330.0	100.0	350.0	0.5	10.0	250.0	0.15	0.2
15.		Well	755.0	7.1	675.0	300.0	310.0	1.0	45.0	230.0	0.14	0.3
16.	Baghanda	Hand Pump	650.0	7.2	450.0	100.0	250.0	0.5	10.0	255.0	0.08	0.2
17.		Well	648.0	7.1	375.0	175.0	310.0	1.5	35.0	160.0	0.10	0.1
18.	Padree	Hand Pump	612.0	7.2	240.0	100.0	398.0	1.0	10.0	332.0	0.15	0.2
19.		Well	670.0	7.1	555.0	425.0	296.0	1.5	45.0	208.0	0.14	0.1
20.	Bharatkoop	Hand Pump	762.0	7.1	480.0	175.0	438.0	1.5	25.0	300.0	0.20	0.1
21.		Well	640.0	7.1	540.0	175.0	325.0	1.5	35.0	95.0	0.16	0.1
22.	Pahadi	Hand Pump	1080.0	7.1	390.0	325.0	350.0	1.0	25.0	400.0	0.14	0.2
23.		Bore Well	575.0	6.5	390.0	125.0	335.0	1.0	10.0	355.0	0.20	0.2
24.	Lodhwara	Hand Pump	580.0	7.2	255.0	150.0	350.0	0.5	45.0	140.0	0.15	0.2
25.		Bore Well	640.0	7.0	225.0	75.0	338.0	1.0	10.0	270.0	0.13	0.2
26.	Karwi	Hand Pump	515.0	7.1	330.0	100.0	388.0	0.5	35.0	239.0	0.22	0.2
27.		Bore Well	638.0	7.0	225.0	75.0	338.0	1.0	10.0	260.0	0.13	0.2

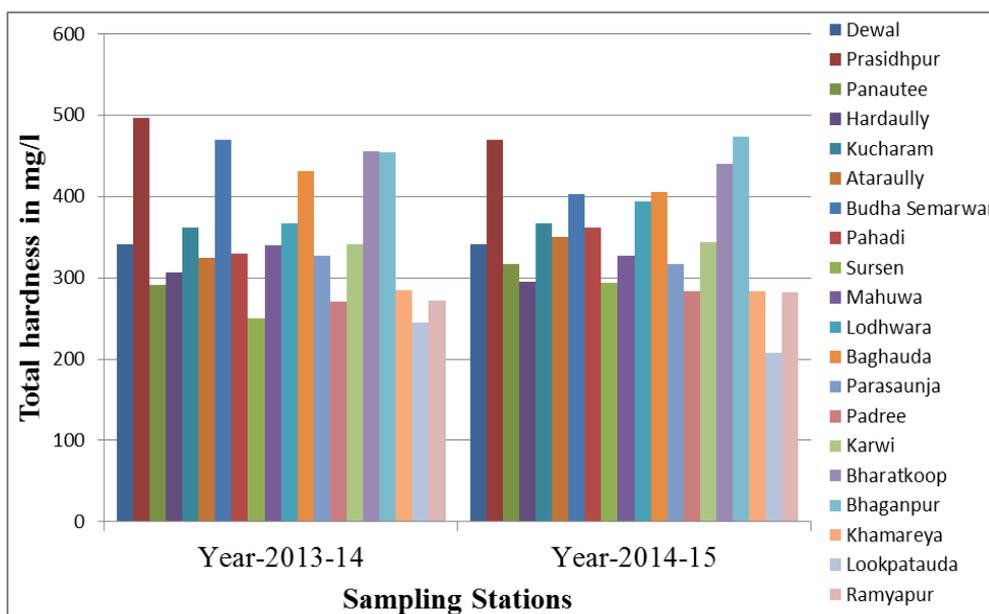


Figure 5: Average total hardness concentration in hand pump water in different sampling stations.

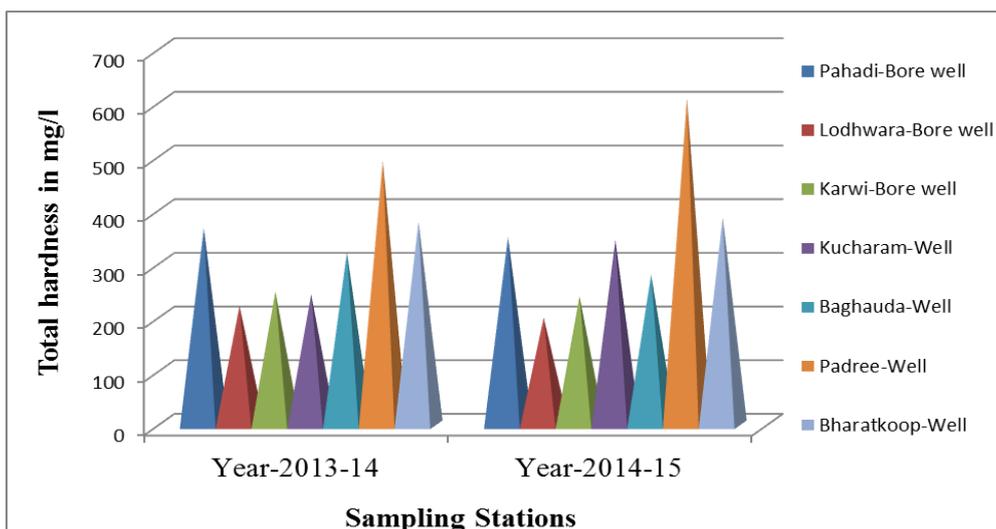


Figure 6: Average total hardness concentration in bore well and well water in different sampling stations.

Chloride

Chloride was widely distributed in nature as salts of sodium (NaCl), potassium (KCl) and calcium (CaCl). The value of chloride for all the ground water samples during year 2013-14 (summer, rainy and winter) ranges from hand pumps -75-325,70-300 and 60-325 mg/l, wells-175-425, 175-500 and 150-450 mg/l and bore-wells-75-125, 100-150 and 50-100 mg/l and during year 2014-15 chloride ranges from hand pumps-75-335, 60-

310 and 75-345 mg/l, wells-150-360, 175-375 and 180-365 mg/l and bore- wells- 45-90, 90-165 and 45-90 mg/l. Chloride content of the all hand- pumps, wells and tube-wells water are under the permissible limit. There is no abnormal change of chloride in the study area. Increase of chloride level in water is injurious to people suffering due to heart and kidney diseases. The chloride in all ground water sampling station details is given in table 1, 2, 3, 4, 5, 6 and figure 7-8.

Table 4: Physico-chemical water quality of rainy season (2014-15)

S.N.	Name of sampling stations	Sources	Parameters									
			TDS (mg/l)	pH	Total hardness (mg/l)	Chloride (mg/l)	Alkalinity (mg/l)	Fluoride (mg/l)	Nitrate (mg/l)	Sulphate (mg/l)	Phosphate (mg/l)	Iron (mg/l)
1.	Dewal	Hand Pump	510.0	7.1	340.0	150.0	370.0	1.0	30.0	250.0	0.25	0.1
2.	Prasidhpur	Hand Pump	380.0	7.3	500.0	165.0	420.0	1.2	30.0	250.0	0.20	0.1
3.	Panautee	Hand Pump	400.0	7.6	300.0	175.0	320.0	1.0	25.0	320.0	0.16	0.1
4.	Hardaully	Hand Pump	1210.0	7.8	310.0	130.0	325.0	1.0	30.0	170.0	0.25	0.1
5.	Ataraully	Hand Pump	580.0	8.1	340.0	135.0	330.0	0.5	30.0	140.0	0.12	0.1
6.	Budha Semarwar	Hand Pump	460.0	7.6	500.0	60.0	300.0	0.5	30.0	88.66	0.16	0.1
7.	Sursen	Hand Pump	720.0	8.2	270.0	135.0	330.0	0.5	30.0	240.0	0.30	0.1
8.	Mahuwa	Hand Pump	620.0	8.1	355.0	120.0	370.0	1.2	35.0	280.8	0.30	0.1
9.	Parasaunja	Hand Pump	550.0	7.5	325.0	165.0	350.0	1.0	10.0	250.5	0.07	0.1
10.	Bhaganpur	Hand Pump	710.0	7.1	510.0	115.0	415.0	1.0	25.0	248.1	0.8	0.1
11.	Khamareya	Hand Pump	728.0	7.1	285.0	75.0	475.0	0.5	35.0	265.2	0.06	0.2
12.	Lookpatauda	Hand Pump	915.0	8.0	320.0	75.0	410.0	0.5	30.0	320.0	0.08	0.2
13.	Ramyapur	Hand Pump	1240.0	7.2	318.0	75.0	410.0	1.5	10.0	260.0	0.05	0.2
14.	Kucharam	Hand Pump	540.0	7.6	385.0	75.0	350.0	1.0	20.0	220.0	0.13	0.1
15.		Well	700.0	7.7	230.0	205.0	325.0	1.0	20.0	220.0	0.15	0.1
16.	Baghdauda	Hand Pump	660.0	7.3	390.0	90.0	280.0	0.5	30.0	240.8	0.06	0.1
17.		Well	720.0	7.2	345.0	335.0	180.0	1.5	35.0	140.0	0.12	0.1
18.	Padree	Hand Pump	650.0	7.3	240.0	90.0	380.0	1.0	25.0	330.0	0.14	0.2
19.		Well	722.0	7.5	570.0	375.0	328.0	1.5	45.0	219.4	0.12	0.1
20.	Bharatkoop	Hand Pump	788.0	7.2	375.0	130.0	425.0	1.5	25.0	325.0	0.35	0.2
21.		Well	990.0	7.4	525.0	175.0	340.0	1.5	45.0	90.0	0.10	0.1
22.	Pahadi	Hand Pump	1150.0	7.7	365.0	310.0	360.0	0.5	30.0	408.0	0.14	0.1
23.		Bore Well	658.0	7.6	340.0	165.0	355.0	1.0	35.0	355.0	0.16	0.1
24.	Lodhwara	Hand Pump	570.0	7.1	505.0	75.0	355.0	0.5	45.0	100.8	0.18	0.1
25.		Bore Well	600.0	7.2	255.0	90.0	355.0	1.0	50.0	245.0	0.13	0.1
26.	Karwi	Hand Pump	508.0	7.2	345.0	115.0	415.0	0.5	25.0	225.0	0.25	0.2
27.		Bore Well	682.0	7.2	285.0	115.0	358.0	1.0	10.0	255.0	0.15	0.2

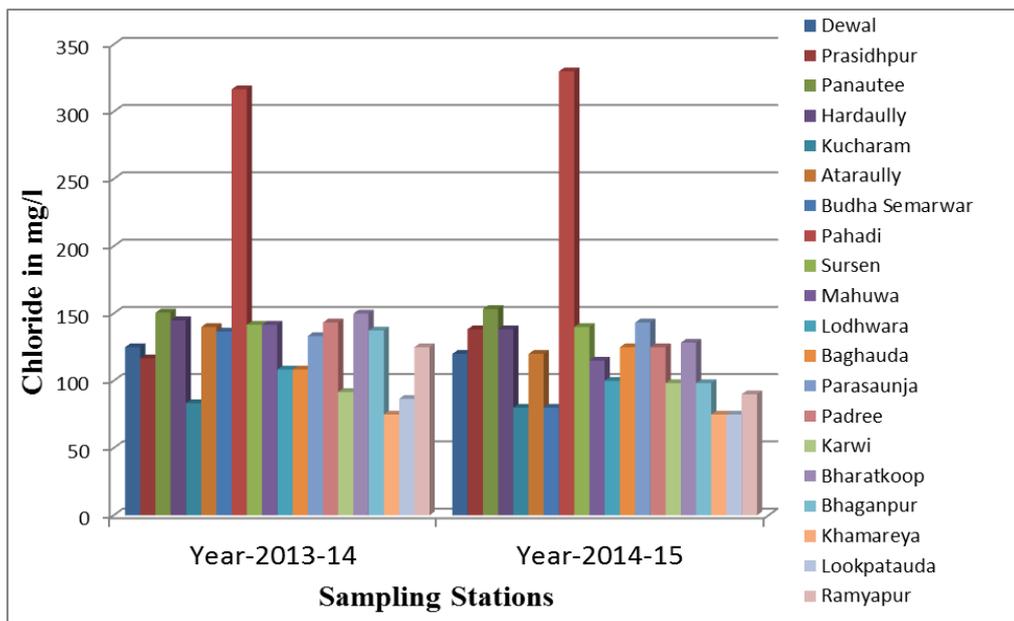


Figure 7: Average chloride concentration in hand pump water in different sampling stations.

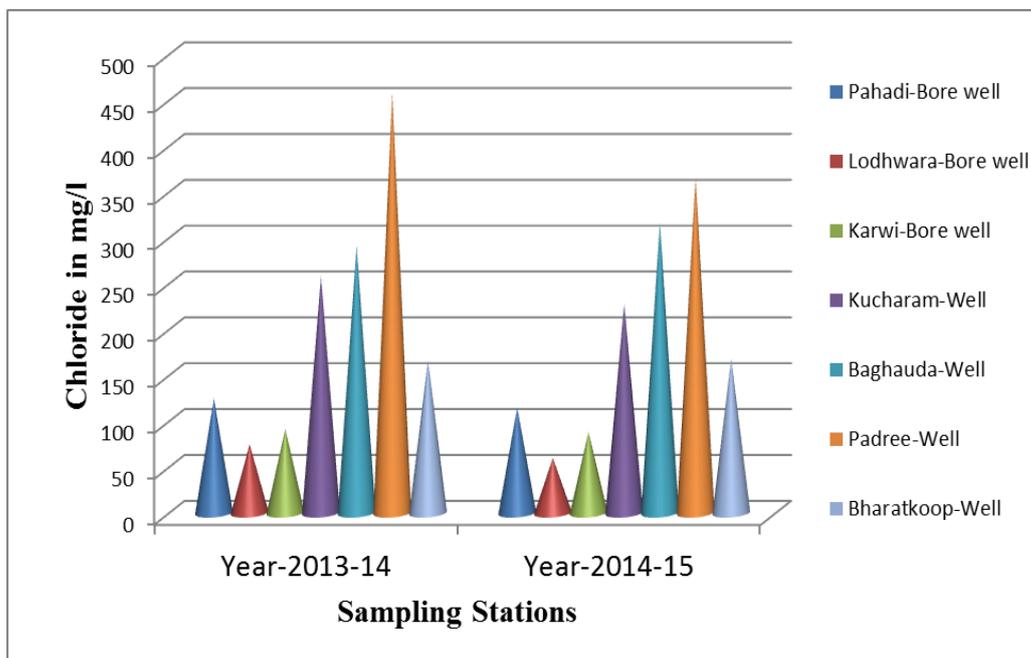


Figure 8: Average chloride concentration in bore well and well water in different sampling stations.

Total alkalinity

Alkalinity of water in its acid neutralization capacity was the sum of all the tritabile bases. The measured value may vary significant with the end point pH used. Alkalinity in excess of alkaline value of alkalinity in drinking water is 200 and 600 mg/l respectively according to BIS. The value of alkalinity in the study area during year 2013-14 (summer, rainy and winter) ranges from Handpumps-250-460, 285-470 and 245-450 mg/l, wells-296-325, 315-335 and 290-315mg/l and bore- wells-335-348, 339-358, 330-390 mg/l and during year 2014-15 ranges from hand pumps-312-475, 280-475 and 280-480mg/l, wells-312-328, 180-340 and 300-330mg/l and bore-wells-320-380, 355-358 and 328-375 mg/l. Alkalinity values are found to be within the WHO permissible limit. There is

no abnormal change of alkalinity in the study area. The alkalinity in all ground water sampling station result is summarized in table 1, 2, 3, 4, 5, 6 and figure 9-10.

Table 5: Physico-chemical water quality of winter season (2014-15)

S.N.	Name of sampling stations	Sources	Parameters									
			TDS (mg/l)	pH	Total hardness (mg/l)	Chloride (mg/l)	Alkalinity (mg/l)	Fluoride (mg/l)	Nitrate (mg/l)	Sulphate (mg/l)	Phosphate (mg/l)	Iron (mg/l)
1.	Dewal	Hand Pump	500.0	6.8	350.0	75.0	365.0	1.0	10.0	260.0	0.20	0.1
2.	Prasidhpur	Hand Pump	375.0	6.9	400.0	130.0	410.0	1.0	10.0	242.0	0.10	0.1
3.	Panautee	Hand Pump	410.0	7.1	300.0	150.0	280.0	1.0	20.0	325.4	0.14	0.1
4.	Hardaully	Hand Pump	1210.0	7.2	260.0	150.0	295.0	1.0	25.0	200.2	0.20	0.1
5.	Ataraully	Hand Pump	520.0	7.8	360.0	105.0	320.0	0.5	45.0	174.0	0.06	0.2
6.	Budha Semarwar	Hand Pump	465.0	7.5	350.0	90.0	310.0	0.5	35.0	90.0	0.18	0.1
7.	Sursen	Hand Pump	800.0	8.1	300.0	150.0	320.0	0.5	10.0	260.0	0.20	0.2
8.	Mahuwa	Hand Pump	528.0	7.5	300.0	105.0	340.0	1.0	10.0	280.00	0.32	0.1
9.	Parasaunja	Hand Pump	500.0	6.8	315.0	130.0	175.0	1.5	10.0	250.0	0.07	0.1
10.	Bhaganpur	Hand Pump	610.0	7.2	460.0	90.0	400.0	1.0	35.0	256.1	0.08	0.1
11.	Khamareya	Hand Pump	710.0	6.9	280.0	75.0	480.0	0.5	35.0	275.2	0.06	0.1
12.	Lookpatauda	Hand Pump	900.0	7.2	150.0	75.0	325.0	1.0	30.0	326.5	0.09	0.2
13.	Ramyapur	Hand Pump	1250.0	7.1	270.0	105.0	350.0	1.0	10.0	265.8	0.04	0.2
14.	Kucharam	Hand Pump	550.0	7.3	360.0	90.0	320.0	0.5	10.0	250.0	0.11	0.1
15.		Well	742.0	7.0	250.0	245.0	300.0	1.0	45.0	200.0	0.13	0.2
16.	Baghauda	Hand Pump	658.0	6.5	451.0	150.0	340.0	0.5	10.0	265.8	0.08	0.01
17.		Well	800.0	6.6	300.0	315.0	320.0	1.0	25.0	140.0	0.10	0.1
18.	Padree	Hand Pump	620.0	7.1	300.0	150.0	375.0	1.0	350.0	340.0	0.15	0.2
19.		Well	700.0	7.6	450.0	365.0	320.0	1.0	25.0	225.0	0.14	0.2
20.	Bharatkoop	Hand Pump	778.0	7.3	475.0	135.0	430.0	1.5	25.0	315.0	0.30	0.1
21.		Well	1000.0	7.1	300.0	180.0	330.0	1.5	35.0	95.4	0.12	0.1
22.	Pahadi	Hand Pump	1100.0	7.2	355.0	345.0	320.0	1.0	25.0	415.0	0.10	0.2
23.		Bore Well	758.0	6.7	375.0	90.0	375.0	1.0	25.0	347.0	0.12	0.2
24.	Lodhwara	Hand Pump	588.0	6.9	335.0	105.0	335.0	0.5	35.0	130.6	0.20	0.2
25.		Bore Well	560.0	7.1	200.0	45.0	328.0	1.0	10.0	250.0	0.16	0.2
26.	Karwi	Hand Pump	510.0	7.2	340.0	90.0	400.0	0.05	25.0	237.0	0.24	0.2
27.		Bore Well	620.0	6.6	225.0	75.0	350.0	1.0	10.0	255.0	0.18	0.2

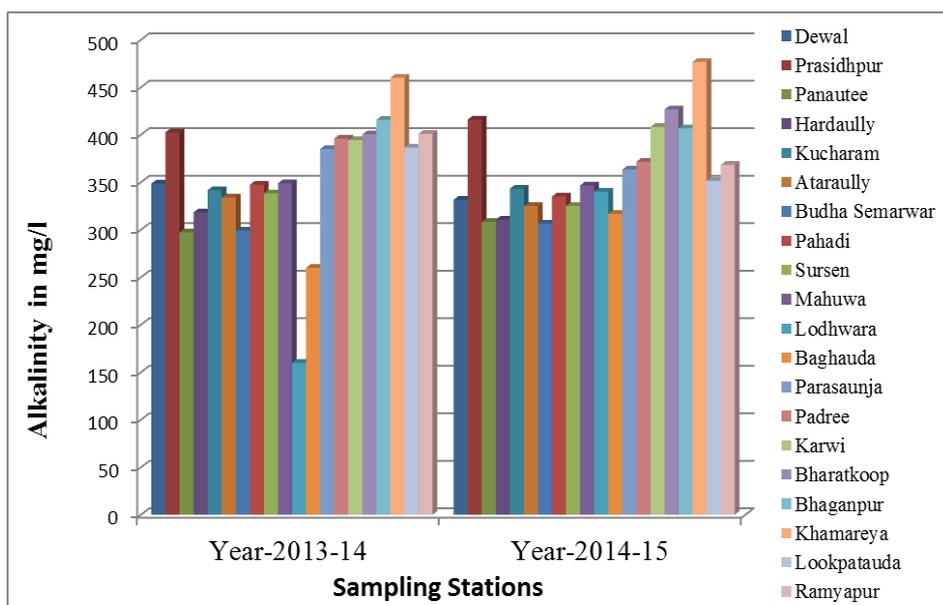


Figure 9: Average alkalinity concentration in hand pump water in different sampling stations.

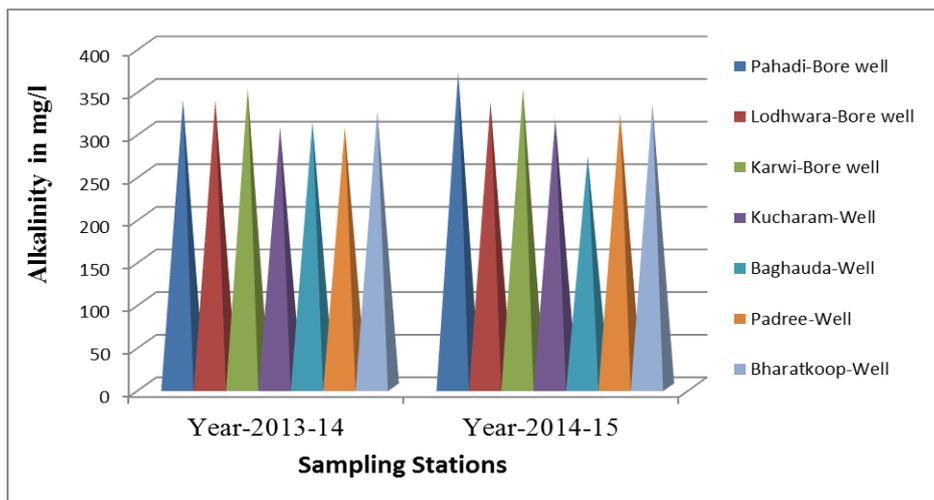


Figure 10: Average alkalinity concentration in bore well and well water in different sampling stations.

Fluoride

Fluoride was important in human nutrition for the normal development of bones. The concentration of fluoride with less than 0.5 mg/l indicate the desirability of fluoridation of the water supplied to prevent the dental decay in children and excess of 1.5 mg/l it will be cause serous dental disorder (bone fluorosis). The fluoride during year 2013-14 (summer, rainy and winter) ranges from hand pump-0.5-1.5, 0.5-1.3 and 0.5-1.5 mg/l wells-1.0-1.5,1.0-1.5 and 1.0-1.5 mg/l and bore- wells-0.5-1.0, 1.0-1.5 and 0.5-1.0 mg/l and during year 2014-15 ranges from hand pumps-0.5-1.5, 0.5-1.5 and 0.5-1.5 mg/l, wells-1.0-1.5,1.0-1.5 and 1.0-1.5 mg/l and bore- well 0.0-1.0,0.0-1.0 and0.0- 1.0 mg/l.

Fluoride concentration was found to be within the WHO recommended value. (1.0- 1.5 mg/l) in all the hand - pumps, wells and bore-wells samples. Bharatkoop and Parsaunja’s hand pumps showed average value of fluoride 1.41mg/l and 1.25mg/l. Wells of Baghauda,

Padree and Bharatkoop showed average value of fluoride 1.25mg/l., 1.25mg/l. and 1.41 mg/l. (These value nearest to the permissible limit of WHO (1.5 mg/l). Fluoride has bath beneficial and detrimental effects on human health. In terms of dental health, the prevalence of dental caries is inversely related to the concentration of fluoride in drinking water, while there is a dose-response relationship between the concentration of fluoride in drinking water and the prevalence of dental fluorosis. In terms of general health, in communities where drinking water and food stuffs are excessively high in fluoride, skeletal fluorosis and bone fracture were the most relevant adverse effect. The public health requirement was to maximize the beneficial effects of fluoride in drinking water supplies for caries prevention, whilst minimizing the unwanted dental and potential general effects. The fluoride in study area in all sampling station summarized are shown in table 1, 2, 3, 4, 5, 6 and figure 11-12.

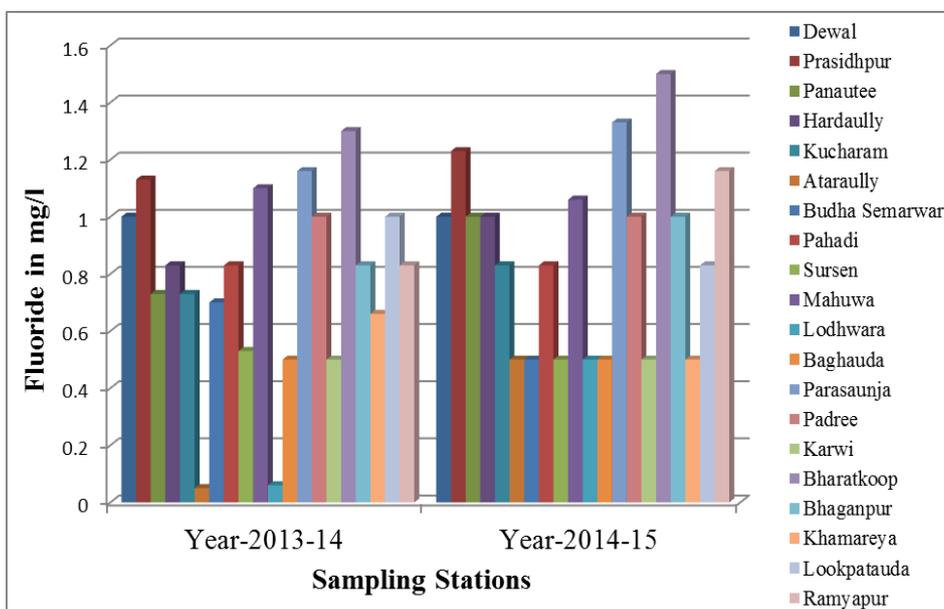


Figure 11: Average fluoride concentration in hand pump water in different sampling stations.

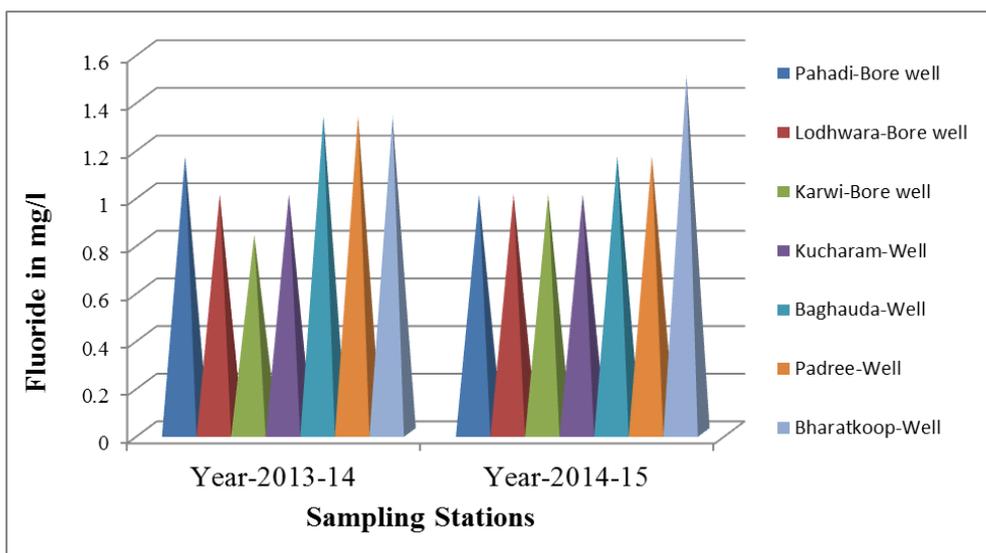


Figure 12: Average fluoride concentration in bore well and well water in different sampling stations.

Nitrate

Nitrate was produced by the oxidation of nitrate. The chief sources of nitrate in natural water are fertilizer and organic matter too much nitrate can cause a blood disorder in babies younger. Than three month and the disorder is called “blue-baby syndrome”. The nitrate during year 2013-14 (summer, rainy and winter) ranges from hand pumps-10-45,10-45 and 10-45 mg/L wells-35-45, 10-45 and 10-45mg/l and bore- wells 10, 10-45 and 10-35 mg/l and during year 2014-15 ranges from hand pump-10-35, 10-45 and 10-45 mg/l wells- 15-35, 20-45

and 20-45 mg/l and bore- wells-10-20, 10-50 and 10-50 mg/l. Nitrate values from all the hand-pumps, wells and bore-wells water is found under the WHO (45 mg/l) permissible limit. Lodhwara hand-pumps average value are 41.66 mg/l. and wells of Padree and Bharatkoop average value of nitrate are 38.33 mg/l. and 39.16 mg/l These value of nitrate are near about of last acceptable limit of WHO (45mg/l). The nitrate in all ground water samples in study area summarized details of present work are given in table 1, 2, 3, 4, 5, 6 and figure 13-14.

Table 6: Physico-chemical water quality of summer season (2014-15)

S.N.	Name of sampling stations	Sources	Parameters									
			TDS (mg/l)	pH	Total hardness (mg/l)	Chloride (mg/l)	Alkalinity (mg/l)	Fluoride (mg/l)	Nitrate (mg/l)	Sulphate (mg/l)	Phosphate (mg/l)	Iron (mg/l)
1.	Dewal	Hand Pump	500.0	7.2	335.0	135.0	380.0	1.0	25.0	265.0	0.28	0.1
2.	Prasidhpur	Hand Pump	410.0	7.2	510.0	120.0	418.0	1.5	20.0	246.8	0.12	0.1
3.	Panautee	Hand Pump	400.0	7.5	350.0	135.0	325.0	1.0	10.0	320.4	0.18	0.1
4.	Hardaully	Hand Pump	440.0	7.6	315.0	135.0	312.0	1.0	25.0	210.8	0.28	0.1
5.	Ataraully	Hand Pump	500.0	7.7	350.0	120.0	325.0	0.5	26.0	180.0	0.10	0.1
6.	Budha Semarwar	Hand Pump	478.0	7.5	360.0	90.0	315.0	0.5	30.0	110.0	0.10	0.1
7.	Sursen	Hand Pump	805.0	8.0	310.0	135.0	315.0	0.5	10.0	245.0	0.22	0.2
8.	Mahuwa	Hand Pump	530.0	7.8	325.0	120.0	330.0	1.0	10.0	295.2	0.30	0.1
9.	Parasaunja	Hand Pump	480.0	7.1	310.0	135.0	365.0	1.5	10.0	230.0	0.08	0.1
10.	Bhaganpur	Hand Pump	630.0	7.3	450.0	90.0	405.0	1.0	30.0	270.0	0.07	0.17
11.	Khamareya	Hand Pump	720.0	7.1	285.0	75.0	475.0	0.5	35.0	278.5	0.06	0.1
12.	Lookpatauda	Hand Pump	890.0	7.3	155.0	75.0	320.0	1.0	25.0	325.0	0.10	0.2
13.	Ramyapur	Hand Pump	1240.0	7.2	260.0	90.0	345.0	1.0	10.0	268.8	0.05	0.2
14.	Kucharam	Hand Pump	520.	7.1	355.0	75.0	360.0	1.0	20.0	258.0	0.10	0.2
15.		Well	750.0	7.4	250.0	235.0	320.0	1.0	15.0	235.0	0.16	0.2
16.	Baghauda	Hand Pump	680.0	6.9	410.0	135.0	330.0	0.5	10.0	252.0	0.08	0.1
17.		Well	850.0	6.9	320.0	300.0	312.0	1.0	30.0	165.0	0.09	0.1
18.	Padree	Hand Pump	610.0	7.3	310.0	135.0	360.0	1.0	25.0	330.0	0.16	0.2
19.		Well	790.0	7.5	455.0	360.0	315.0	1.0	35.0	212.0	0.16	0.2
20.	Bharatkoop	Hand Pump	768.0	7.4	470.0	120.0	425.0	1.5	25.0	312.0	0.30	0.1
21.		Well	1090.0	7.2	310.0	150.0	328.0	1.5	30.0	98.0	0.14	0.1
22.	Pahadi	Hand Pump	1120.0	7.2	365.0	335.0	325.0	1.0	20.0	415.0	0.08	0.2
23.		Bore Well	760.0	6.9	385.0	90.0	380.0	1.0	20.0	358.0	0.14	0.2
24.	Lodhwara	Hand Pump	590.0	7.1	340.0	120.0	330.0	0.5	35.0	141.0	0.18	0.2

25.		Bore Well	570.0	7.1	210.0	45.0	320.0	1.0	10.0	272.0	0.15	0.2
26.	Karwi	Hand Pump	525.0	7.4	345.0	90.0	410.0	0.5	25.0	245.0	0.22	0.2
27.		Bore Well	570.0	7.1	235.0	75.0	345.0	1.0	10.0	264.0	0.16	0.2

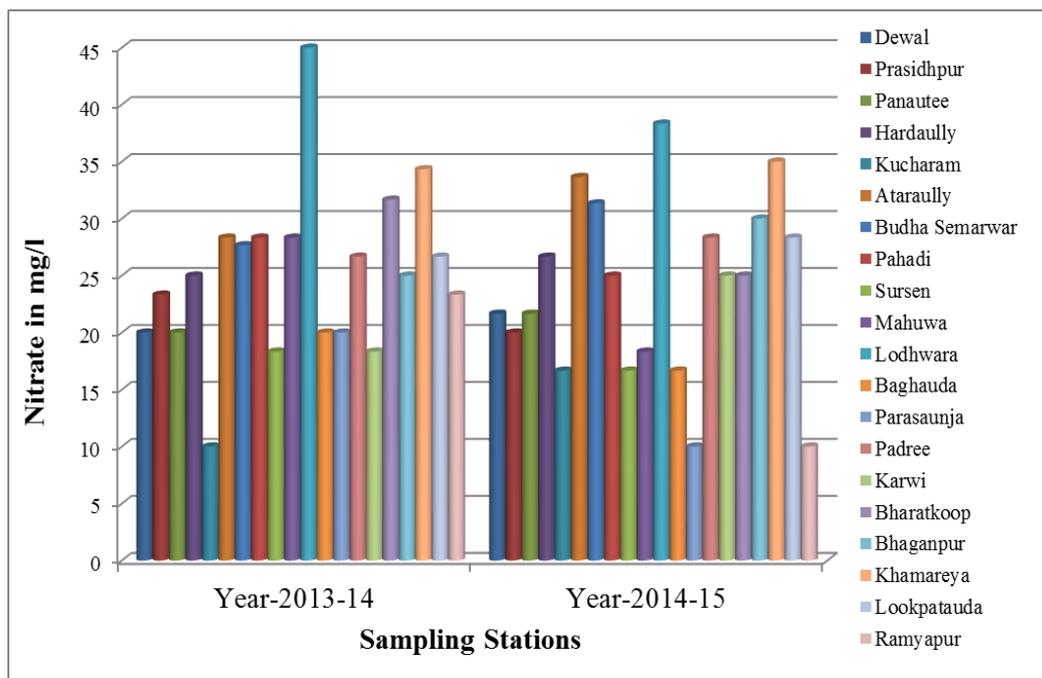


Figure 13: Average nitrate concentration in hand pump water in different sampling stations.

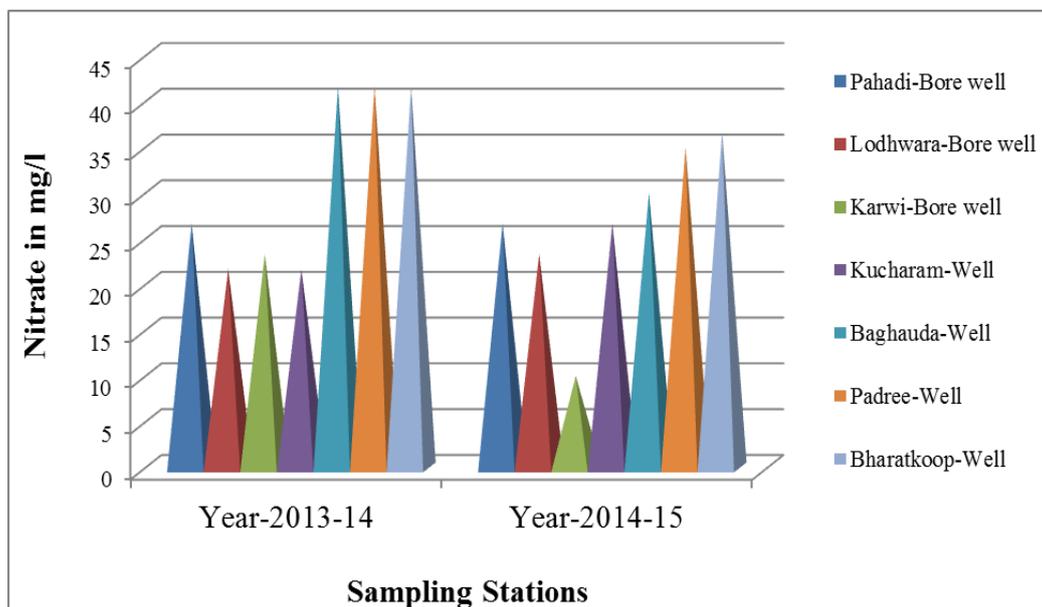


Figure 14: Average nitrate concentration in bore well and well water in different sampling stations.

Phosphate

The only inorganic compounds of phosphorus of significance are the phosphates. These enter in to waters as pollutant through agricultural fertilizers and domestic sewage. The phosphate during year 2013-14 (summer, rainy and winter) ranges from hand pump-0.05-0.36, 0.04-0.45 and 0.04-0.35 mg/l, wells-0.10-0.16, 0.12-0.17

and 0.10-0.14 mg/l and bore- wells 0.13-0.20,0.15-0.20 and 0.12-0.25 mg/l and during year 2014-15 ranges from hand pump 0.05-0.30, 0.05-0.35 and 0.05-0.35 mg/l, wells-0.09-0.16, 0.10-0.15 and 0.10-0.15 mg/l and bore-wells 0.14-0.16,0.13-0.16 and 0.10-0.13 mg/l. In this present study the phosphate values are found within the permissible limit (0.3mg/l) of WHO. There is no abnormal change of phosphate in the all water samples. The phosphate in ground water quality in study area

summarized are shown in table 1, 2, 3, 4, 5, 6 and figure 15-16.

Iron

Iron was an essential element in human nutrition, it is a vital component of hemoglobin, myoglobin, and some other enzyme systems. Hemoglobin transports oxygen to the various tissues of the body; myoglobin stores some oxygen for immediate use by the cell. The iron during year 2013-14 (summer, rainy and winter) ranges from hand pumps-0.1-0.3, 0.1-0.2 and 0.0-0.2 mg/l, wells 0.1-0.3, 0.1-0.2 and 0.1-0.2 mg/l and bore-well 0.1-

0.2, 0.1-0.2 and 0.1-0.2 mg/l and during year 2014-15 iron ranges from hand pump 0.1-0.2 and 0.1-0.2 and 0.1-0.2 mg/l, wells 0.1-0.2, 0.0-0.1 and 0.0-0.1 mg/l and bore-wells 0.0-0.2, 0.1-0.2 and 0.1-0.2 mg/l. The concentration of iron in water from hand-pumps, wells and bore-wells values are found within the permissible limit (0.3-1.0 mg/l) of WHO. There was no abnormal change of iron in the study area. The highest physical and chemical values in Karwi Tehsil at twenty-seven sampling stations were shown in Figure- 26-28. The iron in study area details is given in table 1, 2, 3, 4, 5, 6 and figure 17-18.

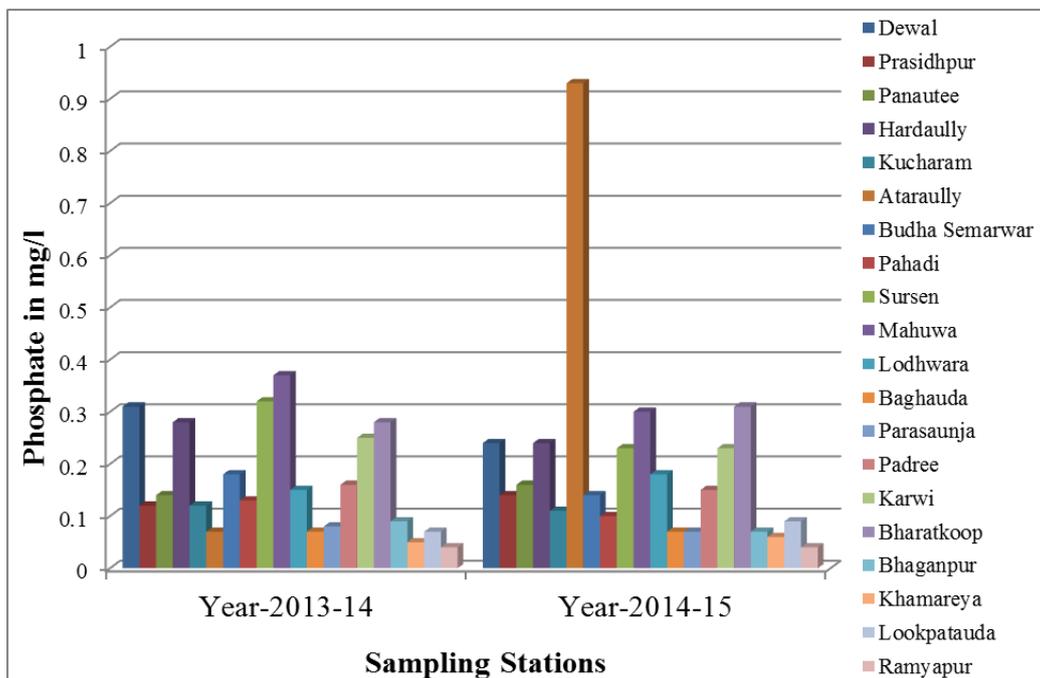


Figure 15: Average phosphate concentration in hand pump water in different sampling stations.

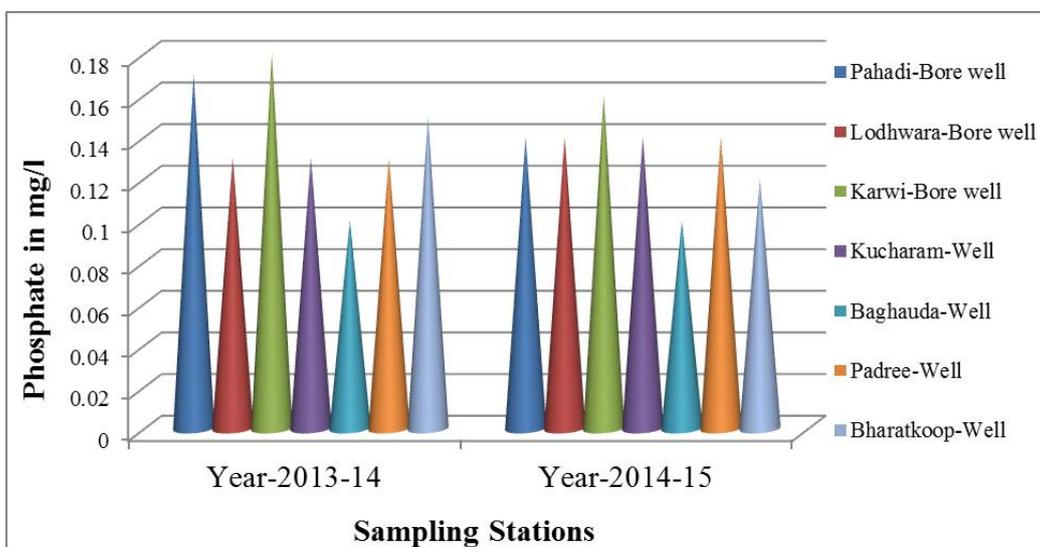


Figure 16: Average phosphate concentration in bore well and well water in different sampling stations.

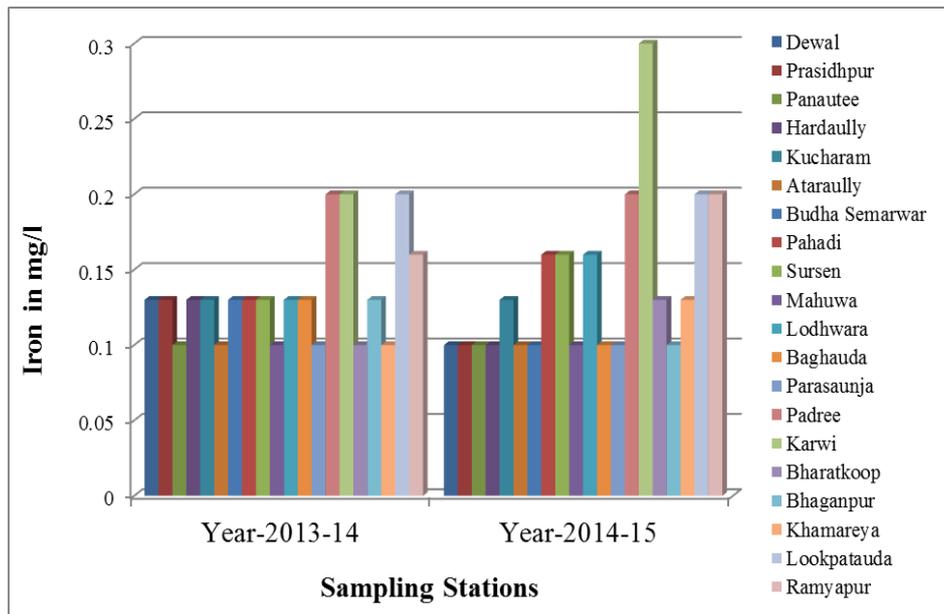


Figure 17: Average Iron concentration in hand pump water in different sampling stations.

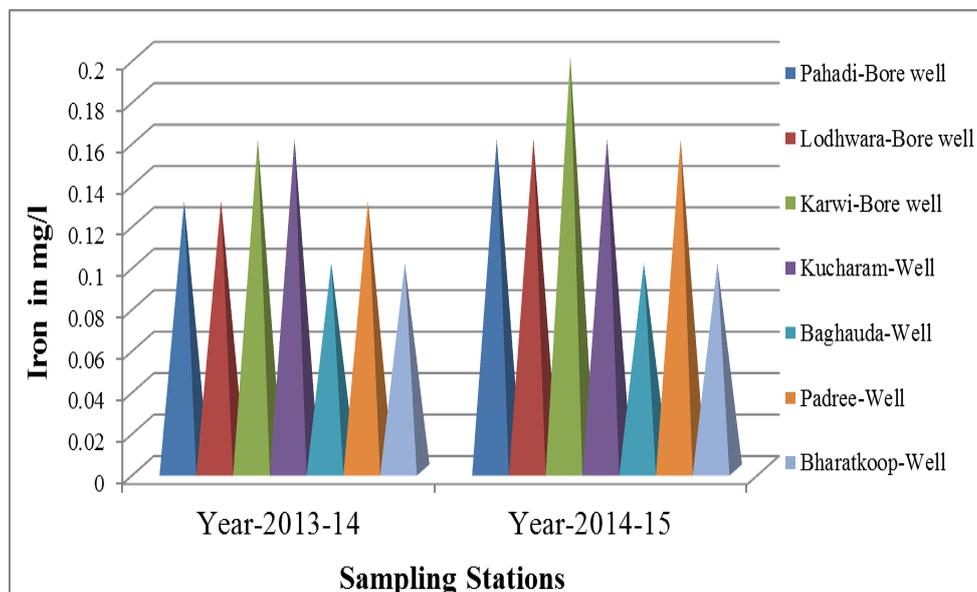


Figure 18: Average Iron concentration in bore well and well water in different sampling stations.

Sulphate

Sulphate was a substance that occurs naturally in drinking water at various concentrations sulphate in drinking water currently has a secondary maximum contaminant level of 250 mg/l. Based on aesthetic effect. The sulphate during year 2013-14 (summer, rainy and winter) ranges from hand pump- 100.0-400.0, 80.66-400.0 and 100.6-410.0 mg/l, wells- 95.0-230.0,80.0-217.4 and 90.0-220.0 mg/l and bore- wells-260.0-355.0, 240.0-350.0, and 260.0-340.0 mg/l and during year 2014-15 sulphate ranges from hand pumps- 110.0-415.0, 88.6-408.0 & 90.0-415.0 mg/l wells- 98.0-235.0, 90.0-220.0 and 95.4-225.0 mg/l and bore-wells- 264.0-358.0,245.0-355.0 and 250.0-347.0 mg/l. The sulphate values for all the hand-pumps, wells and bore-wells water samples are well within the permissible limit (200-400 mg/l) of WHO. High concentration of sulphate may

cause gastro - intestinal irritation particularly when magnesium and sodium ions are also present in drinking water resources. The sulphate in all ground water sampling stations details is given in table 1, 2, 3, 4, 5, 6 and figure 19-20.

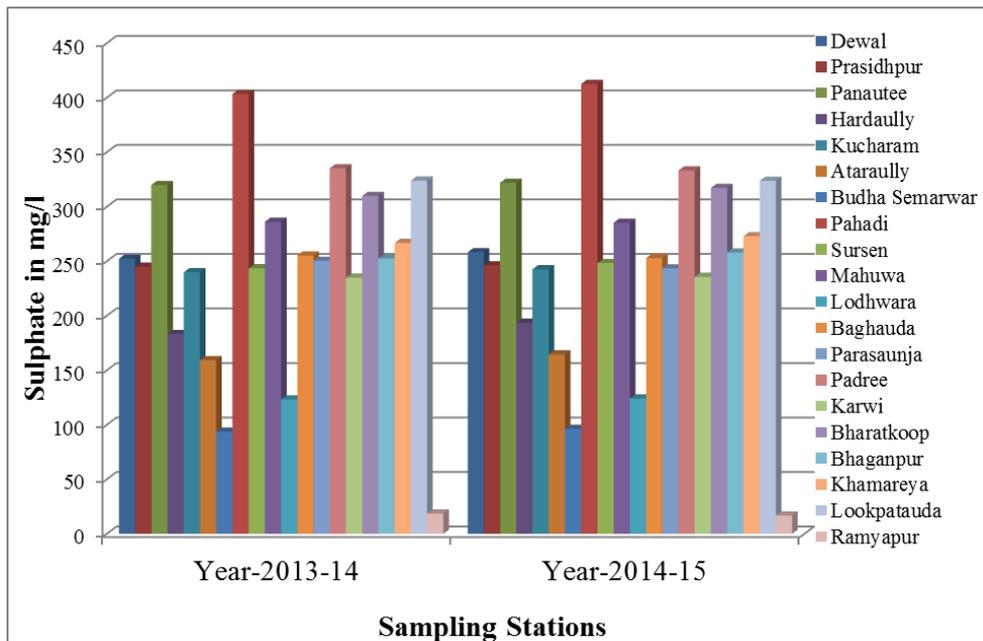


Figure 19: Average sulphate concentration in hand pump water in different sampling stations.

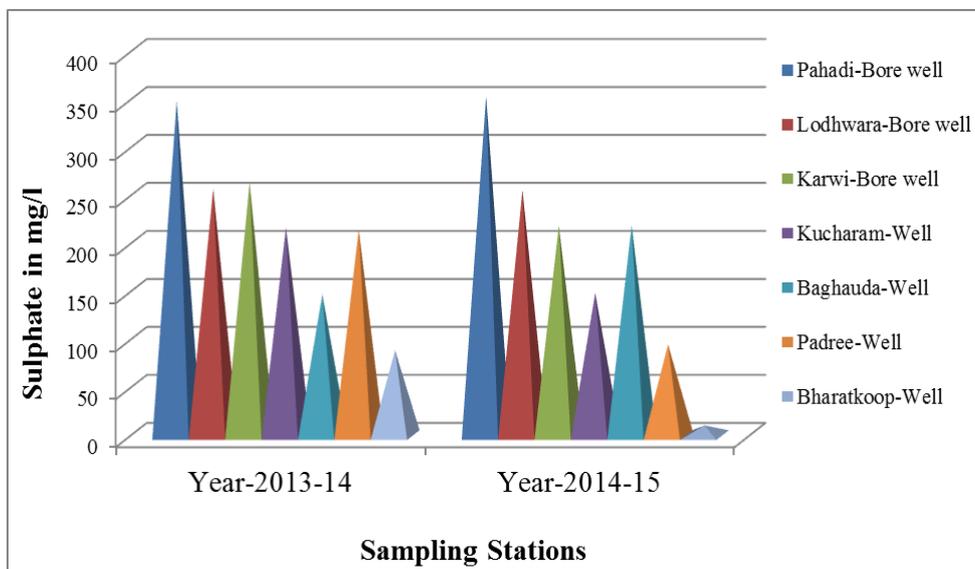


Figure 20: Average sulphate concentration in bore well and well water in different sampling stations.

CONCLUSION

Twenty-seven groundwater samples collected for physico-chemical analysis of water samples of Tehsil Karwi of Chitrakoot District, Uttar Pradesh. Physico-chemical parameters are out of the highest desirable limit or maximum permissible limit set by IS: 10500. Hence, these sample water cannot be absolutely fit for directly drinking. Some essential treatment needed to convert in drinkable water. In conclusion, from the results of the present study it may be said that the people in these rural areas are therefore at higher potential risk of contacting water-borne and/or sanitation related diseases. Both villages water is not absolutely fit for directly drinking purpose need treatments to minimize the contamination. It is recommended that water analysis should be carried out from time to time to monitor the rate and kind of contamination.

It is need of human to expand awareness among the people to maintain the cleanness of water at their highest quality and purity levels to achieve a healthy life.

ACKNOWLEDGMENT

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