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SEASONAL VARIATIONS IN PHYSICO-CHEMICAL CHARACTERISTICS OF SPRING WATER OF SRINAGAR GARHWAL, UTTARAKHAND, INDIA

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Short Profile

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ABSTRACT:
The present study was carried out to determine the seasonal variations of physicochemical parameters in spring water samples from 5 springs (Kolun dhara, Beega dhara, Kamleshwar dhara, Hanuman mandir dhara and kothar dhara) of Srinagar Garhwal, Uttarakhand during March, 2012 to June, 2013. The purpose of this study was to assess to quality of spring water from the sources in three different seasons, such as summer, monsoon and winter. Water samples were analyzed for physic-chemical parameters including Electrical conductivity, pH, DO, Total Hardness, Chloride, Nitrate and Iron. The Result showed the variations of the analyzed parameters in water sample as follows: Electrical conductivity 354.5-696.65 µs/cm; pH 6.6-7.4; DO 1.08-5.05 mg/l; Total hardness as 174.8-306 mg/l; Chloride 45-75 mg/l; Nitrate 3.25-14 mg/l and Iron 0.03-0.38 mg/l respectively. The analyzed physiochemical parameters of water samples from all the 5 springs were permissible limit of APHA water quality guidelines.

KEYWORDS
physico-chemical characteristics , Seasonal variations , physicochemical parameters , production of food.

INTRODUCTION :

Water is essential for survival of all living being in the earth. Water covers about three fourth area of the earth's surface with volume of about one billion cubic kilometers. The total surface water reserves, ocean constitutes 97%, permanent glaciers and ice-caps 2.1%, and remaining only 0.9% water is available as fresh water in the form of rivers, lakes, ponds, streams. Water and life are intricately linked, and water is the main constituent of the human body making up about 80% of total body weight and is the medium for all metabolic activities. More than half of the world's species of plants and animals live in water, and even our terrestrial-derived food is totally dependent on water and often largely composed of water. Water is needed not only for drinking purpose, but also for production of food. Water is also used to generate electricity (hydropower and cooling for thermal power), for navigation, and also for holiday time. For this reason, most ancient civilizations grew near the bank of rivers and other perennial sources of water.

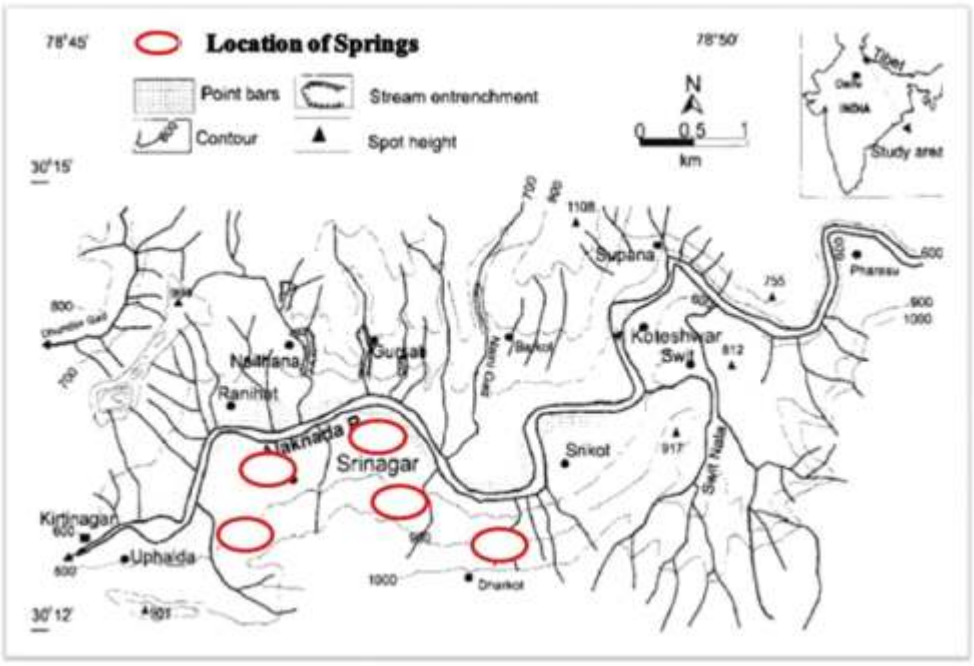
Natural Springs are the source of freshwater for drinking and other household consumption in the Indian Himalayan Mountains. People in rural areas of Uttarakhand primarily depend for drinking water on natural water sources such as springs. The mountain springs known as "Dharas"and "Naula". The water sources of such as springs, in most of cases, are unconfined aquifers where the flow of water is under gravity.

The main objective of this work has to analyze various physico chemical parameters of the spring water of Srinagar Garhwal, Uttarakhand during March, 2012 to June, 2013 in the three different seasons [summer, monsoon and winter].

STUDY AREA

Srinagar valley is located at 30.22 ^{0}N 78.78 ^{0}E at the left bank of Alaknanda river. It has an average elevation of 560 meters (1,837 feet). Srinagar is the hottest place in the Garhwal Hills in summer the temperature reaches 45 °C on some days from May to July. It has chilly winters and the temperature can fall to 2 °C in December and January.

The present study was carried out on the spring water quality of five springs of the Srinagar valley in district Pauri Garhwal, Uttarakhand namely; Kolun dhara, Beega dhara, Kamleshwar, Hanuman Mandir dhara, Kothar dhara.



Fig,1: Location map of springs in study region

MATERIALS AND METHOD

Water samples from the various locations of Srinagar valley districts Pauri Garhwal, Uttarakhand were collected in clean 1 liter polythene bottles in the month of March 2012 to June 2013. Material requirement for sampling and analysis of water is sample containers, chemical and glassware, thermometer, tissue papers, other field measurement are, field note book, pen, pencil, markers, soap and towel, match box, spirit lamp, etc. Physico-chemical parameters, Discharge are measured by the using of bucket and stop watch, Temperature is measured by the thermometer and pH was recorded at the time of sample collection by using pH Meter. Connectivity in the water is determined by the "EUTECH Instrument" of Cyberscan in the laboratory. While other physico-chemical variables were studied using by the standard methods as appropriate (American Public Health Association (APHA), 2005).

RESULT AND DISCUSSION

Table 1 shows that the result of physicochemical parameters during the different seasons, summer monsoon and winter. The maximum discharge value 31.25 l/min (Kothar dhara) was recorded in the monsoon season and minimum 2.65 l/min (Kolun dhara) in the summer season. Water temperature an important factor which influences the chemical, bio-chemical characteristics of water body. The maximum temperature of water 22.8 ^{0}C (Beega and Kamleshwa dhara) was recorded in winter season and a minimum of 20 ^{0}C (Kolun dhara) was recorded in summer and monsoon season. In the present study pH varied from 7.4 maximum at Kothar dhara in the monsoon season and 6.6 minimum (Kolun and Beega dhara) in the winter season, it was within the permissible limit. Most of bio-

chemical and chemical reactions are influenced by the pH. The higher pH values observed suggests that carbon dioxide, carbonate-bicarbonate equilibrium is affected more due to change in physico-chemical condition (Trivedi et al., 2009). The DO varied from maximum 5.05 mg/l at kothar Dhara in the winter season and minimum of 1.08 mg/l at Kolun dhara in the summer season. The fluctuation in the DO value may be difference in water temperature and also to the greater photosynthetic activity. The Total Hardness varied from maximum306 mg/l at Kamleshear dhara in the winter season and minimum of 174.8 mg/l at Hanuman mandir dhara in the summer season. The variations in the total hardness values, that is, higher values may be due to carbonaceous or lime rich bed rock of the valley. The lower values may be due to seasonal variations. The chloride varied from maximum 75 mg/l Kamleshwar dhara in the summer and 45 mg/l Hanuman mandir dhara minimum in summer season. The chloride concentration exhibit small variation within the springs and the variation may be due to the same recharge zone and source of impurities that add chlorides. The Nitrate varied from maximum 14 mg/l at kothar dhara in the summer season and minimum 3.2 mg/l in the summer and mansson season at the Kolun, Beega, Kamleshwar and Hanuman mandir dhara. The fluctuations in the nitrite values or the higher concentration of nitrogen compounds in water may be due to domestic sewage which enters into the ground water through leeching from soil. The Iron varied from maximum 0.38 mg/l at Beega dhara in the summer season and minimum 0.03 mg/l Beega and Kamleshwar dhara in the mansoon and winter season.

The correlation co-efficient between the various physicochemical parameters were calculated and presented in the Table 2. In summer season significant positive relationship was obtained between various variables such as discharge and nitrate (0.77), Water temperature and DO (0.83), Conductivity with DO (0.74), Total Hardiness (0.98) and Chlorides (0.91), DO with Total hardiness (0.69) and chloride (0.73) and total hardiness and chloride (0.96), the strong negative relationship was obtained between discharge and iron (-0.86), iron and nitrate (-0.75), water temperature and pH (-0.81).

Similarly, in monsoon season a strong positive relationship was obtained between various variables such as water temperature and conductivity (0.61), pH and discharge (0.85), DO with discharge (0.96), water temperature (0.61) and pH (0.76), chloride with conductivity (0.77) and water temperature (0.85), nitrate with discharge (0.98), pH (0.82) and DO (0.88). A strong negative relationship was obtained between total hardiness with DO (-0.82) and discharge (-0.64).

Similarly, in winter season strong relationship was obtained between conductivity and water temperature (0.62), pH and discharge (0.87), total hardiness with conductivity (0.65) and chloride (0.76), iron and nitrate (0.74). A strong negative relationship was obtained between conductivity and discharge (-0.76), water temperature and pH (-0.75), chloride and nitrate (-0.89), total hardiness and iron (-0.99).

CONCLUSION

In the present study, the correlation coefficient of 9 Physic-chemical parameters of the springs revealed that all the parameters were more or less correlated with one another. In the correlation regression study, we can conclude that all the parameters are more or less correlated with each other, especially strong correlations observed between Conductivity and Total Hardness (0.98) in the summer seasion, Discharge and Nitrate (0.98) in monsoon and Total hardness and Iron (-0.99) was found higly negetive correlation in winter seasion.

The development and use of natural spring to provide water supply for hilly region is a good innovation and very well solution of water scarcity problem. The results of the present study showed that physic-chemical analysis of the spring water, all parameters are within the permissible limits of APHA. The results indicate that the all springs are non-polluted and can be used for drinking, domestic and other proposes.

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12.

Table 1: Physicochemical parameters analysis of spring water samples in different seasons in Srinagar Garhwal, Uttarakhand

Name of springs	Discharge (l/m)	Water temperature (^{0}C)	Conductivity (µs/cm)	pH	DO (mg/l)	Total hardness (mg/l)	Chloride (mg/l)	Nitrate (mg/l)	Iron (mg/l)
Summer									
Kolun dhara	2.65	20	473.9	7.3	1.08	218.5	55	5	0.3
Beega dhara	4.38	21	354.5	7.1	1.1	180	48	6.3	0.38
Kamleshwar dhara	5.02	21.8	672	6.9	1.65	294.5	75	7	0.21
Hanuman mandir dhara	12.71	21.5	398.7	6.8	1.35	174.8	45	8	0.13
Kothar dhara	12.31	21	367.7	7.3	1.3	185	55.5	14	0.1
Mansson									
Kolun dhara	9.14	20	586.85	7	1.2	245	65	3.25	0.03
Beega dhara	10.14	20.3	492.8	6.7	1.23	199	65	3.25	0.3
Kamleshwar dhara	11.28	20.8	693.88	7.1	1.23	220	70	3.25	0.33
Hanuman mandir dhara	25.49	20.5	583.1	7.3	1.3	184	65	5.5	0.03
Kothar dhara	31.25	20.8	616.65	7.4	1.3	200	70	7.75	0.08
Winter									
Kolun dhara	4.24	22.3	665.15	6.6	4.78	266	61	5.5	0.1
Beega dhara	5.97	22.8	583	6.6	3.18	268	56	7.75	0.11
Kamleshwar dhara	6.73	22.8	696.65	6.8	3.7	306	65.5	3.25	0.03
Hanuman mandir dhara	16.1	22.3	562.1	6.9	4.43	280	66.5	3.25	0.08
Kothar dhara	15.12	21.5	532.75	7.1	5.05	260	56	5.5	0.12

Table-2: Correlation matrix showing the relation between difference water quality parameter during the summer, monsoon, winter seasons in the year 2012-13.

Summer Season									
Parameters	Discharge	Water Temperature	Conductivity	pH	DO	Total Hardness	Chloride	Nitrate	Iron
Discharge	1	0.42	-0.42	-0.25	0.25	-0.59	-0.35	0.77	-0.86
Water Temperature		1	0.36	-0.81	0.83	0.3	0.34	0.23	-0.42
Conductivity			1	-0.34	0.74	0.98	0.91	-0.34	0.02
pH				1	-0.61	-0.21	-0.1	0.25	0.2
DO					1	0.69	0.73	0.2	-0.53
Total Hardness						1	0.96	-0.3	0.1
Chloride							1	-0.03	-0.1
Nitrate								1	-0.75
Iron									1
Monsoon Season									
Discharge	1	0.57	0.14	0.85	0.96	-0.64	0.34	0.98	-0.52
Water Temperature		1	0.61	0.59	0.61	-0.48	0.85	0.54	0.31
Conductivity			1	0.58	0.07	0.28	0.77	0.13	0.1
pH				1	0.76	-0.28	0.5	0.82	-0.57
DO					1	-0.82	0.26	0.88	-0.37
Total Hardness						1	0.02	-0.53	-0.02
Chloride							1	0.41	0.31
Nitrate								1	-0.51
Iron									1
Winter Season									
Discharge	1	-0.65	-0.76	0.87	0.48	-0.16	0.12	-0.39	0.18
Water Temperature		1	0.62	-0.75	-0.88	0.61	0.35	0.02	-0.58
Conductivity			1	-0.58	-0.28	0.65	0.46	-0.29	-0.7
pH				1	0.56	-0.05	0.01	-0.42	0.07
DO					1	-0.45	-0.01	-0.28	0.35
Total Hardness						1	0.76	-0.69	-0.99
Chloride							1	-0.89	-0.8
Nitrate								1	0.74
Iron									1

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