STUDY OF SEASONAL FLUCTUATION IN PHYSICOCHEMICAL PARAMETERS OF THREE FRESH WATER SPRINGS OF DISTRIC RAJOURI- JAMMU

HARSH VARDHAN*

*Department of zoology, Govt. PG. College Nowshera, India

Abstract

Groundwater is a well-known component of the hydrological cycle and forms the main source of water supply for drinking purposes in most parts of India. It forms a vital source of water supply in rural India and is often the only source of water supply, mostly in remote villages. Ground water plays a key role in agriculture, for both watering of crops and for irrigation during dry season. It is expected that about 45% of irrigation water requirement in India is met from ground water sources (Jain *et al*., 2009). Spring water is the main source of water providing life to people in the mountain region especially in the Himalaya. Groundwater exploitation for rural water supply without proper understanding of its chemistry and changes that may be induced by physical processes and anthropogenic activities may be counterproductive. On a national scale, groundwater accounts for about 50–80% of domestic water use and 45–50% of irrigation (Kumar *et al*., 2005; Mall *et al*., 2006; Bhat *et al*., 2010). The water samples for the present study were collected from June 2013 to may 2015 from Sialsui, Bali and Kalakote in district Rajouri. The findings of the analysis will prove to be quite informative, to the daily consumers of the water. Water samples were collected on bi monthly basis. In order to assess the ground water quality, the water samples were analyzed for different physicochemical properties, e.g., Temperature, pH, Electrical Conductivity (EC),, Calcium Hardness(CH), Total Alkalinity(TA), Free Carbon Dioxide(FCD) etc The results were compared with Bureau of Indian Standard for drinking water (BIS) and World Health Organization (WHO). The results indicated that certain sources of water are suitable for drinking and other house hold consumption for the people of the region.

Keywords: Physico-Chemical, Fresh Water, Springs, WHO, BIS, anthropogenic.

Introduction

In the 1800s, springs were considered a practically guaranteed source of safe-to-drink water. Springs were categorized according to supposed mineral contents: sulphur springs, magnesia springs, chalybeate (or iron) springs, etc., and each type was considered medicinal for specific ailments. Water is one of the essentials that support all forms of plant and animal life (Vanloon & Duffy 2005). More than one billion people in the world do not have suitable drinking water, and two to three billions lack access to basic sanitation services. About three to five millions die annually from water-related diseases (Kumar & Singh, 2006). In the hydrological cycle, less than 0.1% of the metals are actually dissolved in the water and more than 99.9% are stored in sediments and soils (Karbassi *et al*., 2007, Pradit *et al.,* 2010).

The growth of industrial area is rapid and very fast thus related anthropogenic activities have also been increased like waste discharge from industries, transportation and domestic activities. The domestic waste generated is directly enters into the different sites of water bodies without any treatment (Tambekar *et al* 2012). Also the continuous flow from agricultural waste water contaminates the water source of surrounding area. This entire problem affects the water resources and ultimately human health. Water is one of the three major components of the environment; therefore, there exists a close linkage between the quality of water and the environment which bears an almost importance for eco-system. Natural bodies of water are not absolutely pure as various organic compounds and inorganic elements remain in dissolved form (Tambekar *et al* 2012).

The physical and chemical quality of water vary according to the basin shape and size, depth, light penetration, precipitation, location, temperature, chemical nature of surrounding soil and dissolved minerals, pH, etc, and the biological components of the habitats depend upon them. If all the physical, chemical and biological parameters are in optimum condition the balance between these is maintained. Many people depend on fresh water supplies from groundwater. It provides water for domestic use for a large part of the Indian population. It is one of the major sources of water for irrigation and small scale industries. Fertilizers and pesticides are used in agriculture resulted in deterioration of water quality rendering serious environmental problems posing the threat on human beings (Lantzy & Mackenzie 1979, Nriagu 1979, Roos 1994) and sustaining aquatic biodiversity (Ghosh & Vas 1997, Das *et al*., 1997).Therefore the present study was done with this aim that the data from this study will contribute to the knowledge of the physical and chemical properties of three fresh water springs of district Rajouri viz sialsui, Bali and kalakote springs of district Rajouri.

TABLE 1 SHOWING THE TOTAL ALKALINITY OF SIALSUI SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						297.5 ± 24.7^{B}	350.0 ± 98.9^{C}	435.0 ± 21.2^{C}	402.5 ± 24.7^{D}	297.5 ± 24.7^{B}	385.0 ± 49.4^{C}	350.0 ± 98.9^{B}
2014	297.5 ± 24.7^{B}	350.0 ± 98.9^{C}	435.0 ± 21.2^{C}	402.5 ± 24.7^{D}	297.5 ± 24.7^{B}	297.5 ± 24.7^{B}	350.0 ± 98.9^{C}	435.0 ± 21.2^{D}	402.5 ± 24.7^{D}	297.5 ± 24.7^{B}	385.0 ± 49.4^{C}	350.0 ± 98.9^{B}
2015	297.5 ± 24.7^{C}	350.0 ± 98.9^{C}	435.0 ± 21.2^{C}	402.5 ± 24.7^{D}	297.5 ± 24.7^{B}							

TABLE 2 SHOWING THE TOTAL ALKALINITY OF BALI SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						262.5 ± 24.7^{B}	297.5 ± 24.7^{B}	297.5 ± 74.2^{B}	315.0 ± 49.4^{C}	350.0 ± 49.4^{B}	280.0 ± 49.4^{B}	332.5 ± 74.2^{B}
2014	297.5 ± 74.2^{B}	315.0 ± 49.4^{B}	350.0 ± 49.4^{B}	280.0 ± 49.4^{B}	332.5 ± 74.2^{D}	262.5 ± 24.7^{B}	297.5 ± 24.7^{B}	297.5 ± 74.2^{C}	315.0 ± 49.4^{C}	350.0 ± 49.4^{B}	280.0 ± 49.4^{B}	332.5 ± 74.2^{B}
2015	297.5 ± 74.2^{C}	315.0 ± 49.4^{B}	350.0 ± 49.4^{B}	280.0 ± 49.4^{B}	332.5 ± 74.2^{B}							

TABLE 3 SHOWING THE TOTAL ALKALINITY OF KALAKOTE SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						175.0 ± 49.9^{A}	227.5 ± 74.2^{A}	262.5 ± 24.7^{B}	210.0 ± 49.4^{B}	175.0 ± 49.4^{A}	157.5 ± 24.7^{A}	245.0 ± 49.4^{A}
2014	262.5 ± 24.7^{A}	227.5 ± 74.2^{A}	192.5 ± 74.2^{A}	192.5 ± 24.7^{A}	210.0 ± 98.9^{A}	175.0 ± 49.4^{A}	227.5 ± 74.2^{A}	262.5 ± 24.7^{B}	210.0 ± 49.4^{B}	175.0 ± 49.4^{A}	157.5 ± 24.7^{A}	245.0 ± 49.4^{A}
2015	262.5 ± 24.7^{B}	227.5 ± 74.2^{A}	192.5 ± 74.2^{A}	192.5 ± 24.7^{A}	210.0 ± 98.9^{A}							

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TABLE 4 SHOWING THE CALCIUM HARDNESS OF SIALSUI SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						164.0±0.0^{D}	164.0±5.65^{E}	174.0±2.82^{F}	174.0±2.82^{E}	168.0±11.3^{F}	178.0±2.82^{F}	162.0±2.82^{D}
2014	166.0±2.8^{F}	166.0±8.4^{E}	170.0±2.8^{G}	168.0±11.3^{F}	174.0±2.8^{F}	174.0±2.8^{F}	168.0±11.3^{E}	174.0±2.8^{G}	170.0±14.1^{E}	176.0±0.0^{F}	162.0±2.8^{F}	168.0±5.6^{F}
2015	170.0±8.48^{F}	172.0±0.00^{E}	164.0±5.65^{F}	168.0±11.3^{F}	168.0±5.65^{E}							

TABLE 5 SHOWING THE CALCIUM HARDNESS OF BALI SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						196.0±5.65^{E}	202.0±8.48^{F}	206.0±2.82^{F}	200.0±5.65^{F}	194.0±2.82^{G}	204.0±5.65^{F}	198.0±8.48^{E}
2014	206.0±2.8^{G}	202.0±8.4^{F}	200.0±5.6^{G}	206.0±2.8^{G}	194.0±2.8^{G}	200.0±5.6^{F}	200.0±11.3^{F}	198.0±2.8^{G}	200.0±11.3^{F}	202.0±2.8^{F}	192.0±0.0^{G}	202.0±2.8^{G}
2015	206.0±2.82^{G}	204.0±5.65^{F}	194.0±2.82^{G}	204.0±0.00^{G}	192.0±0.0^{F}							

TABLE 6 SHOWING THE CALCIUM HARDNESS OF KALAKOTE SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						146.0±8.48^{D}	142.0±8.48^{D}	142.0±2.82^{D}	150.0±2.82^{D}	142.0±2.82^{E}	142.0±8.48^{D}	148.0±5.65^{D}
2014	142.0±8.4^{E}	146.0±2.8^{D}	142.0±2.8^{E}	146.0±8.4^{E}	150.0±2.8^{E}	144.0±5.6^{D}	142.0±2.8^{D}	146.0±2.8^{E}	142.0±8.4^{D}	144.0±11.3^{D}	152.0±0.0^{E}	142.0±2.8^{E}
2015	146.0±2.82^{E}	146.0±2.82^{D}	138.0±2.82^{E}	152.0±0.00^{E}	150.0±2.82^{D}							

TABLE 7 SHOWING THE P^{H} OF SIALSUI SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						$8.0\pm.70^{A}$	7.5 ± 0.0^{A}	7.5 ± 0.0^{A}	8.5 ± 0.0^{B}	$8.0\pm.70^{B}$	8.5 ± 0.0^{D}	$8.0\pm.70^{B}$
2014	$8.0\pm.70^{A}$	7.5 ± 0.0^{A}	7.5 ± 0.0^{A}	8.5 ± 0.0^{B}	$8.0\pm.70^{C}$	$8.0\pm.70^{A}$	7.5 ± 0.0^{A}	7.5 ± 0.0^{A}	8.5 ± 0.0^{B}	$8.0\pm.70^{B}$	8.5 ± 0.0^{C}	$8.0\pm.70^{B}$
2015	$8.0\pm.7^{B}$	$7.3\pm.35^{A}$	7.0 ± 0.0^{A}	$7.7\pm.35^{A}$	$7.2\pm.35^{A}$							

TABLE 8 SHOWING THE P^{H} OF BALI SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						7.5 ± 0.0^{C}	7.5 ± 0.0^{C}	7.5 ± 0.0^{C}	7.5 ± 0.0^{C}	7.5 ± 0.0^{C}	7.5 ± 0.0^{C}	7.5 ± 0.0^{C}
2014	8.5 ± 0.0^{D}	$8.0\pm.70^{D}$	7.5 ± 0.0^{D}	$7.0\pm.70^{C}$	7.5 ± 0.0^{D}	8.5 ± 0.0^{B}	$8.0\pm.70^{B}$	8.5 ± 0.0^{D}	$8.0\pm.70^{C}$	7.5 ± 0.0^{A}	$8.0\pm.70^{B}$	8.5 ± 0.0^{B}
2015	8.5 ± 0.0^{B}	$8.0\pm.70^{A}$	7.5 ± 0.0^{A}	7.5 ± 0.0^{A}	8.5 ± 0.0^{B}							

TABLE 9 SHOWING THE P^{H} OF KALAKOTE SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						$8.2\pm.35^{B}$	8.0 ± 0.0^{B}	$8.6\pm.21^{B}$	8.5 ± 0.0^{B}	$8.2\pm.35^{A}$	8.0 ± 0.0^{B}	7.5 ± 0.0^{A}
2014	$8.2\pm.35^{B}$	$8.6\pm.21^{C}$	8.5 ± 0.0^{D}	8.0 ± 0.0^{A}	$7.7\pm.35^{A}$	$8.2\pm.35^{B}$	8.0 ± 0.0^{A}	$8.6\pm.21^{C}$	8.5 ± 0.0^{B}	$8.2\pm.35^{A}$	8.0 ± 0.0^{A}	7.5 ± 0.0^{A}
2015	$8.2\pm.3^{A}$	$8.2\pm.35^{A}$	$8.6\pm.21^{C}$	8.5 ± 0.0^{B}	8.0 ± 0.0^{A}							

TABLE 10 SHOWING THE ELECTRICAL CONDUCTIVITY OF SIALSUI SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						$0.5\pm.05^{A}$	$0.5\pm.07^{A}$	$0.4\pm.00^{A}$	$0.5\pm.04^{A}$	$0.5\pm.01^{A}$	$0.5\pm.03_{B}$	$0.5\pm.4^{B}$
2014	$0.5\pm.05^{B}$	$0.5\pm.00^{B}$	$0.5\pm.01^{B}$	$0.5\pm.01^{B}$	$0.5\pm.06^{B}$	$0.5\pm.04^{B}$	$0.5\pm.07^{B}$	$0.5\pm.06^{B}$	$0.5\pm.02^{B}$	$0.5\pm.03^{B}$	0.4 ± 0.0^{B}	$0.5\pm.06^{B}$
2015	$0.6\pm.09^{B}$	$0.4\pm.04^{B}$	$0.5\pm.03^{B}$	$0.4\pm.14^{B}$	$0.4\pm.02^{A}$							

TABLE 11 SHOWING THE ELECTRICAL CONDUCTIVITY OF BALI SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						$0.5\pm.05^{A}$	$0.5\pm.07^{A}$	$0.4\pm.00^{A}$	$0.5\pm.04^{A}$	$0.5\pm.01^{A}$	$0.5\pm.03_{B}$	$0.5\pm.4^{B}$
2014	$0.6\pm.01^{B}$	$0.5\pm.07.^{B}$	0.6 ± 0.0^{C}	$0.6\pm.01^{B}$	0.6 ± 0.0^{B}	$0.5\pm.07^{B}$	$0.6\pm.02^{B}$	$0.5\pm.09^{B}$	$0.5\pm.04^{B}$	0.5 ± 0.0^{B}	0.5 ± 0.0^{B}	$0.6\pm.05^{B}$
2015	$0.6\pm.03^{B}$	$0.5\pm.06^{B}$	$0.6\pm.02^{C}$	$0.6\pm.14^{D}$	0.7 ± 1.2^{A}							

TABLE 12 SHOWING THE ELECTRICAL CONDUCTIVITY OF KALAKOTE SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						$0.5\pm.02^{A}$	$0.5\pm.01^{A}$	$0.5\pm.02^{A}$	$0.5\pm.04^{A}$	$0.5\pm.02^{A}$	$0.5\pm.09_{B}$	$0.6\pm.09^{B}$
2014	$0.5\pm.05^{B}$	$0.5\pm.04^{B}$	$0.5\pm.04^{B}$	0.6 ± 0.0^{B}	$0.5\pm.02^{B}$	0.6 ± 0.0^{B}	$0.6\pm.01^{B}$	$0.5\pm.07^{B}$	$0.5\pm.06^{B}$	$0.5\pm.07^{B}$	$0.6\pm.04^{C}$	$0.5\pm,.04^{B}$
2015	$0.0\pm.01^{C}$	$0.6\pm.08^{C}$	$0.5\pm.07^{B}$	$0.5\pm.00^{C}$	$0.6\pm.04^{A}$							

TABLE 13 SHOWING THE FREE CARBON DIOXIDE OF SIALSUI SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						147.0 ± 8.4^{B}	147.0 ± 12.7^{C}	105.0 ± 9.8^{B}	138.0 ± 16.9^{C}	153.0 ± 9.8^{C}	139.0 ± 29.6^{B}	139.0 ± 9.8^{C}
2014	96.0 ± 22.6^{b}	141.0 ± 21.2^{b}	136.0 ± 33.9^{b}	122.0 ± 5.6^{b}	153.0 ± 9.8^{d}	105.0 ± 18.3^{b}	142.0 ± 5.6^{b}	95.0 ± 4.2^{b}	144.0 ± 8.4^{b}	122.0 ± 33.9^{c}	120.0 ± 56.5^{c}	144.0 ± 16.9^{d}
2015	136.0 ± 33.9^{c}	105.0 ± 18.3^{b}	95.0 ± 4.2^{b}	136.0 ± 33.9^{b}	139.0 ± 29.6^{b}							

TABLE 14 SHOWING THE FREE CARBON DIOXIDE OF BALI SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						144.0 ± 1.41^{D}	144.0 ± 33.9^{C}	142.0 ± 19.7^{C}	171.0 ± 14.1^{D}	148.0 ± 22.6^{C}	164.0 ± 25.4^{C}	187.0 ± 4.2^{E}
2014	130.0 ± 2.8^{c}	159.0 ± 18.3^{b}	158.0 ± 36.7^{c}	172.0 ± 36.7^{d}	152.0 ± 45.2^{d}	177.0 ± 29.6^{c}	145.0 ± 35.3^{b}	160.0 ± 5.6^{c}	176.0 ± 8.4^{b}	177.0 ± 18.3^{c}	191.0 ± 12.7^{e}	179.0 ± 15.5^{d}
2015	158.0 ± 36.7^{d}	177.0 ± 29.6^{c}	$160.\ 0\pm5.6^{c}$	158.0 ± 36.7^{b}	164.0 ± 25.4^{c}							

TABLE 15 SHOWING THE FREE CARBON DIOXIDE OF KALAKOTE SPRING OF DISTRICT RAJOURI FROM JUNE 2013 TO MAY 2015

YEAR	JAN	FEB	MAR	APRL	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
2013						55.0 ± 7.0^{A}	55.0 ± 21.2^{A}	89.0 ± 12.7^{B}	85.0 ± 49.4^{B}	95.0 ± 21.2^{B}	103.0 ± 4.2^{B}	85.0 ± 7.0^{B}
2014	65.0 ± 21.2^{a}	65.0 ± 21.2^{a}	90.0 ± 14.1^{b}	95.0 ± 7.0^{b}	80.0 ± 14.1^{b}	55.0 ± 21.2^{a}	69.0 ± 41.0^{a}	109.0 ± 15.5^{b}	115.0 ± 7.0^{b}	108.0 ± 2.8^{b}	83.0 ± 32.5^{b}	75.0 ± 7.0^{b}
2015	90.0 ± 14.1^{b}	55.0 ± 21.2^{a}	109.0 ± 15.5^{b}	55.0 ± 21.2^{a}	103.0 ± 4.2^{b}							

DISCUSSION

The quality of ground water is the resultant of all the processes and reactions that act on the water from the moment it is condensed in the atmosphere to the time it is discharged by a well or spring and varies from place to place and with the depth of the water table. In places where groundwater is majorly used, a variety of land and water based human activities are causing pollution of this valuable resource. Pollution of groundwater is a major concern in many cities and industrial clusters all over the world. There is thus the need for agencies responsible for environmental protection to constantly monitor and control the use of the area for agriculture and other human activities to keep the ground water safe from contamination. The average value of physicochemical analysis of water in the present study are represented in the (Table 1-15) water appeared to be transparent with slight turbidity in the rainy seasons. Algal mats were found on the surface of springs. Moreover water temperature in sialsui, Bali and kalakote springs ranges from 11 c^o to 17 c^o kalakote,12.5 c^o to 17.5 c^o and sialsui spring 11 c^o to 17.5 c^o. Alkalinity of water may be due to the presence of one or more of a number of ions. The alkalinity of groundwater is mainly due to hydroxide, carbonates and bicarbonates. The alkalinity of water may be defined as its capacity to neutralize acids. The acceptable limit of alkalinity is 200 mg/l and in the absence of alternate water source, alkalinity up to 600 mg/l is acceptable for drinking. The total alkalinity of analyzed water samples varied from 175 to 435mg/l. Total alkalinity of all samples is exceeding the desirable limit prescribed by WHO/BIS. During the present study total alkalinity was observed from 297 mg/l to 435 mg/l in sialsui spring, 262 mg/l to 350 mg/l in Bali spring and 175 mg/l to 262 mg/l from kalakote spring. However in kalakote spring the minimum value is 175 mg/l that is slightly lower than the desirable limit as prescribed by the BIS but the higher value is 262 mg/l i.e slightly greater than the desirable limit as prescribed by the BIS. But the desirable limit of who is 100 mg/l. Calcium is the most abundant natural element, present in all natural waters. The most common source of calcium in groundwater is through the erosion of rocks, such as limestone and minerals, such as calcite. Calcium associates in groundwater with carbohydrates and various organic acids. Calcium is an essential nutritional element for human being and aids in maintaining the structure of plant cells and soils. The concentration of calcium ranged 162 mg/l to 178 mg/l from sialsui spring while 192 mg/l to 206 mg/l form bali spring and 142 mg/l to 152 mg/l from the kalakote spring . The results show that all the water samples were within permissible limits prescribed by BIS and IS (Indian Standard Specification). The acceptable limits of Ca 2^+ is75 mg/l .The recommended value of WHO and BIS are given in Table-16. The measurement of pH is one of the most frequently used tests in water chemistry (Hem,1985). It is the expression of hydrogen ion concentration, more precisely, the hydrogen ion activity. pH is an important parameter in assessing the water quality. Acidic conditions will prevail as pH value decreases and alkaline conditions will prevail as the pH value increases. The pH value in the present study of all these three springs showed slight fluctuation ranged from 7.0 to 8.6 respectively. The minimum value of pH of sialsui spring is 7.0 while as the maximum value is 8.5. However the value of Bali spring is 7.5 to 8.5 and that of kalakote spring is 7.5 to 8.6.the pH of all the spring is slightly toward basic level. pH as such has no adverse effect on health, however a lower value below 4 will produce sour taste; and a higher value above 8.5 an alkaline taste.. The low pH does not cause any harmful effect (Boominathan and Khan, 1994). The results show that all the water samples were within permissible limits prescribed by WHO/BIS. The WHO and BIS recommendation of pH is 6.5- 8.5. In the current study the pH range is a safe for drinking purpose. The ability of a solution to conduct an electrical current is governed by the migration of solutions and is dependent on the nature and numbers of the ionic species in that solution. This property is called electrical conductivity. Electrical Conductivity (EC) in natural waters is the normalized measure of the water's ability to conduct electric current. It is a useful tool to assess the purity of water. The permissible limit for electrical conductivity (EC) is 300 µS/cm. EC of water is directly proportional to its dissolved mineral matter contents. (Manivasakam, 1985). EC for all the samples are to much less than the standard prescribed limit of BIS/WHO standard limits. EC of the collected samples ranged from 0.4 to 0.7 µS/cm. Potable water should not have high electrical conductivity (Hutton, 1983)Carbon dioxide quickly combines with water to form carbonic acid, a weak acid. The presence of carbonic acid in water ways may be good or bad depending on the water's pH and alkalinity. If the water is alkaline, the carbonic acid present will be useful to neutralize the high pH of water. But if the water is already acidic (low pH), the carbonic acid will only make things worse by making it more acidic (Chetia., 2014) In year 2013, during present investigation the free carbon dioxide content minimum 95mg/l while as the maximum 153mg/l was found in spring sialsui where as the minimum value of free carbon dioxide from the spring Bali is 130mg/l and maximum 187mg/l and that of the spring kalakote the minimum value is 55mg/l while as the maximum is 109mg/l. Too much CO_2 usually accumulate in water body as a result of decomposition of organic matter and Respiratory activity of plants and animals. Under poor illumination tree also consumes so much O_2 and generate so much CO_2 especially in a Lentic system that ph is shifted strongly to the lower (= acidic) side which in soft water is injurious to aquatic life.

Table- 16: Showing permissible & Desirable limits of various parameters by BIS/WHO in comparison to Present Study Samples

S.No.	PARAMETERS	PRESENT STUDY		BIS		WHO	
		MIN	MAX	D	P	D	P
1.	PH	7.0	8.6	6.5	8.5	7	9.5
2.	TOTAL ALKALINITY	175	435	200	600	100	500
3.	CALCIUM HARDNESS	142	206	75	200	75	-
4.	TEMPERATURE	11	17.5	-	-	30	40
5.	FREE CARBON DIOXIDE	55	187	-	-	-	-
6.	ELECTRICAL CONDUCTIVITY	0.4	0.7	300	-	750	2500

Material and Methods:-

The physio-chemical characteristics of water was monitored on monthly basis. Water samples were collected from Chazza, Patnanara, and sialsui springs of district Rajouri from June,2013 to April,2015 in sterile bottles. Temperature was measured by using mercury bulb thermometer *insitu*. Following physico-chemical properties were studied by using the multi-parameter field water testing kit of capacity care and development unit (CCDU), Department of PHE Government of Jammu and Kashmir. The statistical analysis was done using SPSS 20 and the minimum, maximum, mean, and standard deviations were calculated for each parameter. ANOVA were applied to test the significance of the differences between the groups.

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