RESEARCH ARTICLE

IMPACT OF DRINKING WATER QUALITY ON THE HEALTH STATUS OF PEOPLE IN SOPORE TEHSIL OF DISTRICT BARAMULLA (J&K, INDIA)

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ARTICLE INFO	ABSTRACT
	Water is the basic resource necessary for sustaining all human activities. So its provision in desired quantity and quality is of utmost importance. One of the most serious environmental health problems faced globally especially by those living in developing regions is related to lack of clean water resources and sanitation facilities which is mainly caused through anthropogenic activities (Gunther *et al*, 2006).Waterborne borne diseases are a major concern globally and in particular in developing countries and its adverse impacts have taken a toll on human health. In the backdrop of this, study was proposed to make an assessment on the water quality of the study area and to find its impact on human health. Water samples taken from the different drinking water sources revealed low to heavily contaminated and not recommended for drinking purposes as per WHO standards. In the study water related diseases like acute diarrheal cases were found 24.36 percent, Hepatitis A 10.90 percent, Enteric fever 8.36 percent and other diseases (dermatitis, conjunctivitis and irritated bowl etc) were56.36 percent(computed field survey with medical records). So study was designed to assess the prevalence and establish the relationship between water sources and the incidence of water borne diseases.

INTRODUCTION

Seventy one percent of the earth's surface is covered with water and is very important natural resource for sustaining life on this planet (National Environment Research Council, 2007). But only 2.5 percent of total water of the earth's surface is fresh and usable for consumption. Still this little precious water has been polluted on a large scale mainly through anthropogenic activities. Contaminated water may not cause immediate effect on the human health but can be witnessed a brutal fatal in the long run. Fresh water scarcity ranks among the most urgent environmental challenges of this century. The contamination of water has important repercussions for the environment and human health. Drinking water contamination with different chemicals and heavy metals, released from various anthropogenic sources has become a global concern. Providing safe and secure water to people around the world and promoting sustainable use of water resources must be the fundamental objectives of the global governing bodies. As estimated by World Health Organization (WHO) that 1.1 billion people globally lack basic access to drinking water

resources, while 2.4 billion people have inadequate sanitation facilities, which accounts for many water related acute and chronic diseases (Sarkar *et al.*, 2007). Over 4 lac children die in India every year due to diseases erupting from unsafe drinking water. While 21 per cent of communicable diseases in India are water related which is mainly because the availability of water, particularly in rural India depends on untreated surface ground water (Dept. of Drinking water and sanitation report 2011, UNICEF).

Study Area

The study has been carried out in Sopore Tehsil of north Kashmir, drained by the water from various rivers originating at different sources in the upper reaches of south Kashmir which gets polluted and contaminated during its course before entering in the study area. Sopore known as suyyapur in antiquity is a prosperous Tehsil in the Baramulla district of the state Jammu & Kashmir. It is located at $34^0 30'$N latitude, $74^0 47'$E longitude, constitutes an area of 320sq.kms. and is renowned as "Apple town of Asia".

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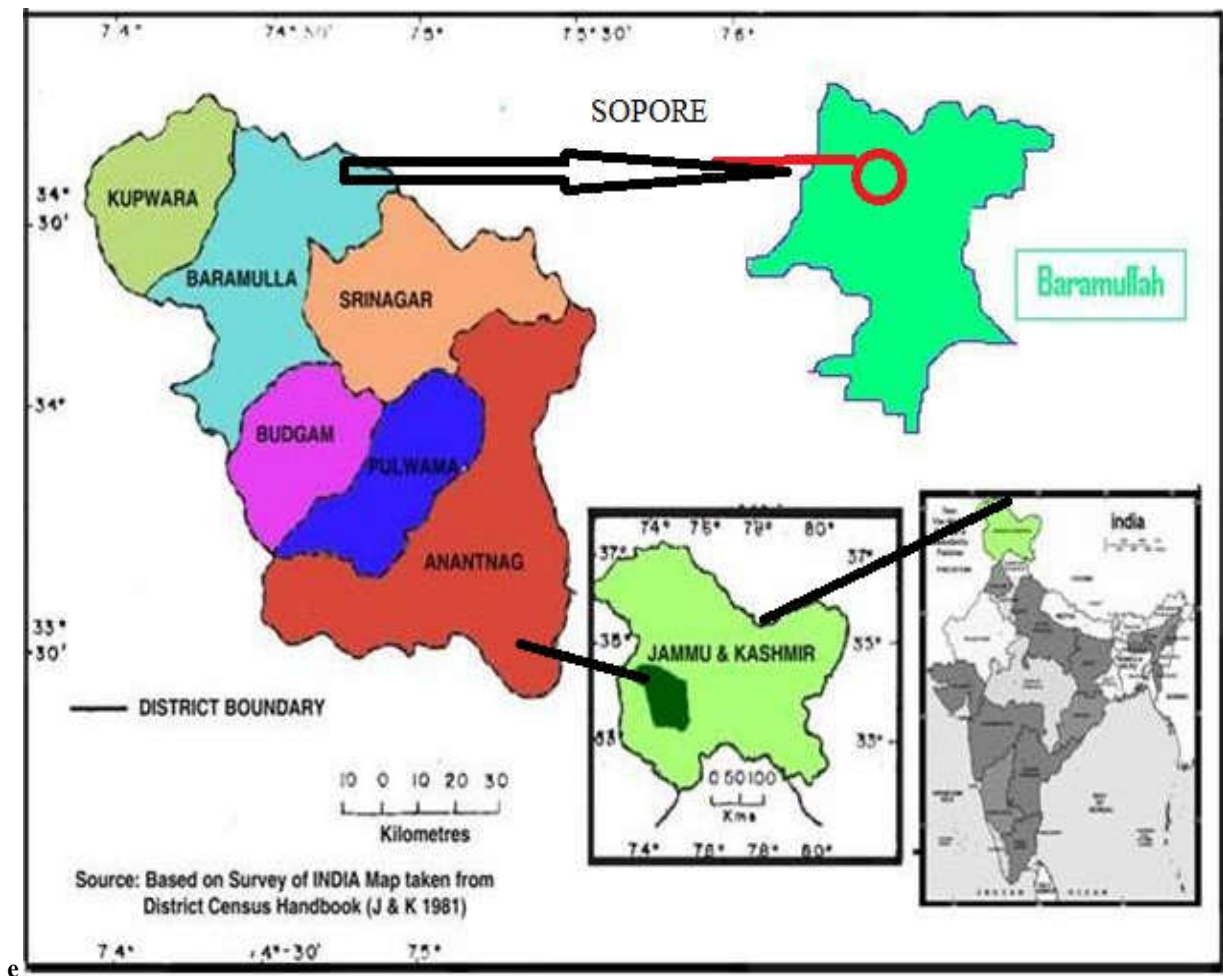*Department of Geography, University of Kashmir, India.*

Fig. A. Map of the Study Area

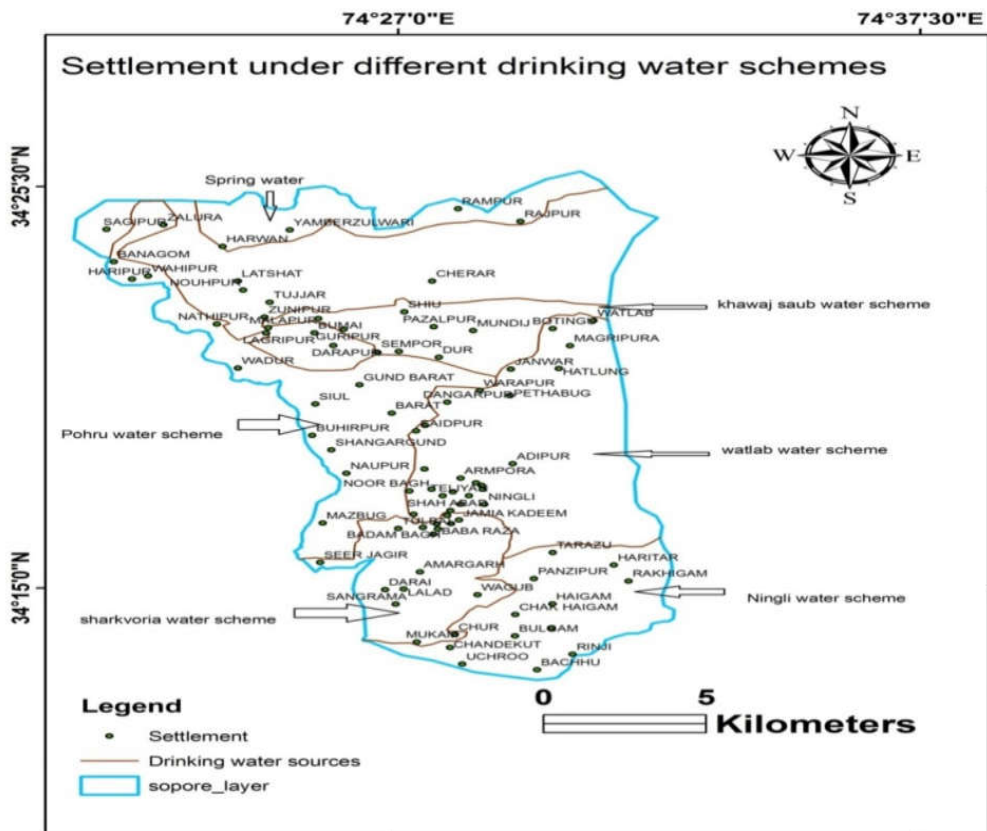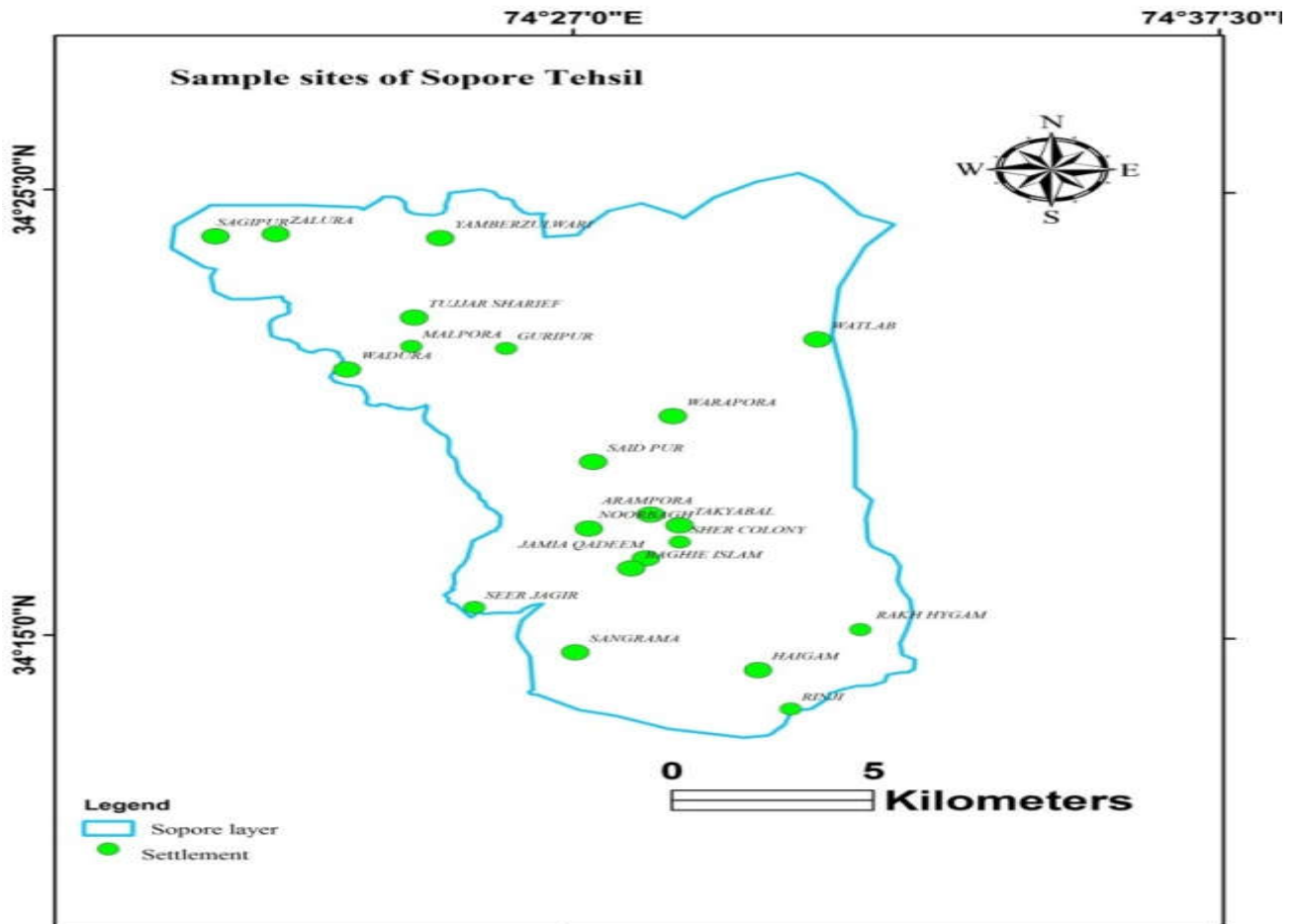Source: *J & K Topo sheet 1961 & Municipal map of Sopore town*

Fig. B. Settlements under Different Drinking Water Schemes

Source: *J & K Topo sheet 1961 & Municipal map of Sopore town*

Fig. C. Sample Sites of Sopore Tehsil

MATERIALS AND METHODS

Both primary and secondary data was used to have better results. In the secondary data Toposheet 1961(satellite imagery) and municipal map of soper town were used to digitize settlement map and drainage map of the study area using Arc GIS software 9.2, besides this reports of Directorate Health J&K and Census data of India 2011 was used to incorporate socio-economic and health scenario of the study area . While as primary data has been collected during survey of 500 households with the help of well-designed, semi-structured questionnaire. Questionnaire was designed to evoke descriptive accounts of the informant's everyday life, water usage, attitude towards drinking water and experience with the waterborne diseases. Data collected was statistically analyzed and results were obtained. Besides this a separate survey was carried out to collect water samples from various sites of different sources of drinking water and were tested in the water testing laboratory(Center of Research for Development, university of Kashmir, Public Health Engineering laboratory, Sopore.

Study sites

The sample sites were chosen by grouping settlement into different zones according to drinking water sources (shown in Fig b) while sample size were chosen on the basis of

household size grouped into 0-250,251-500,501-1000 and above 1001. Out of the total 33559 households (Census 2011) in the study area, 1.5 percent of it was taken as sample unit which accounts as 500 households. Samples sites have been taken, with villages and wards as the primary unit and household size as the ultimate unit of selection have been followed by adopted systematic sampling technique.

RESULTS

Source of drinking water

Out of 500 households 66 percent were having the usability of tap water, 15percentwell water, and 11percent tube well, 5percentspring and 3percent were fetching water directly from rivers and streams.

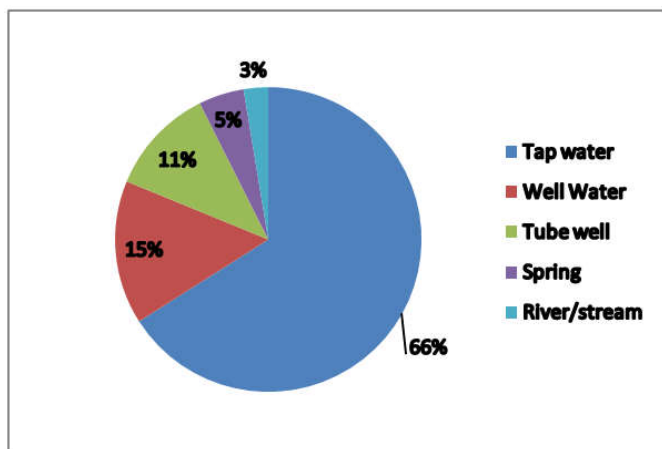### Treatment Methods

About 50percentof total households use drinking water without any treatment process. Half of the households from the selected sites take precautionary measures like boiling of water and modern means of gadgets like water purifiers.

Water Quality Assessment

After collecting the water samples from different drinking water sources, quality assessment of drinking water was

gauged by performing various water tests in the laboratories such as in Center of research for Development, University of Kashmir, Public Health Engineering laboratory, Sopore, Kashmir and water test kits by following the manufactures protocol and results were recorded and finally compared with the WHO and BIS standards.

Source: *Based on field Study, 2014*

Fig. D. Source of drinking water
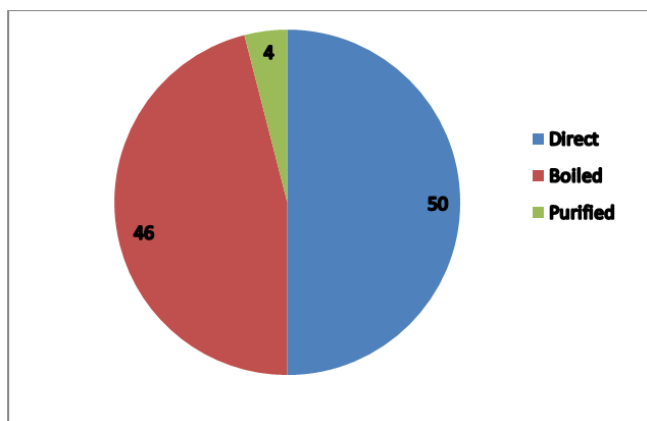
Source: *Based on field Study, 2014*

Fig. E. Water Treatment Methods

Various physical and chemical parameters which were assessed:

i)   Colour
ii)   pH
iii)   Hardness
iv)   Calcium
v)   Alkanity
vi)   turbidity,
vii)   Electric conductivity
viii) Total dissolved solids
ix)   Dissolved oxygen
x)   Biological oxygen Demand
xi)   Nitrate ,Sulfate, Chloride, fluoride and phosphate concentration

The above table reveals that all the sample water sources exhibit marked variations in all most all parameters suggested

by WHO and Bureau India Standards shown underlined in the above table thereby not recommended for drinking purposes and at times is injurious for health.

**Table 1.1. Different sample sites with source of drinking water**

Codes	Name	Source
A	Seer jagir	Tap water(Sharkvoria ws), unfiltered
B	Seer jagir	River
C	Noorbagh	Well water
D	watlab	Watlab water scheme
E	Rinji	Tube well
F	Shercolony	Tap water(jehlum ws)
G	Jamia qadeem	Tape water(shrakvoria ws) filtered
H	yamberzulwari	Spring
I	Tujjar	Tape water(tujar water scheme)
J	wadura	Tap water(pohru water scheme)
K	Sagipur	Well water
L	Rakh Hygam	Tap water(ningli water scheme)
M	Malpora	Tap water(khawj water scheme)

Source: *Based on Field Study, 2014*
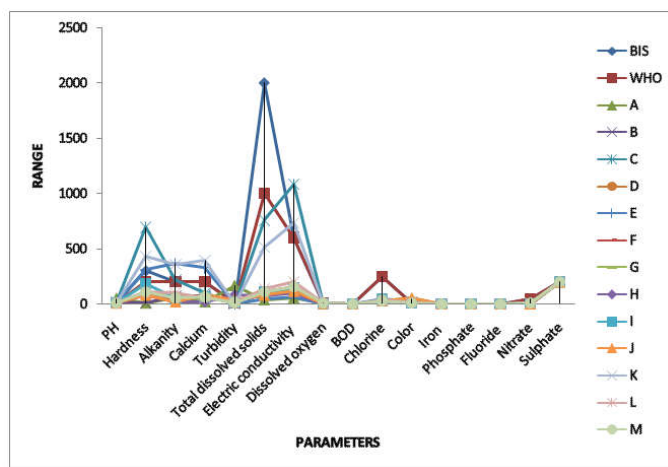
Source: *Computed from WHO and BIS Standards*

Graph A. Deviation of water sample parameters from admissible limits of WHO, BIS standards
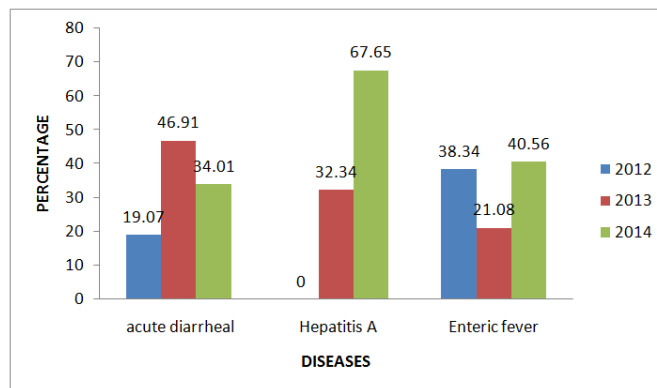
Source: *Sub-District Hospital Sopore (J&K state)*

Graph B. Prevalence of Waterborne Diseases in Sopore Tehsil

The above shows that apart from Diarrhea, Hepatitis-A and Enteric fever, the cases of other waterborne diseases such asdermatitis, conjunctivitis, irritated bowl etc were recorded in high proportion i.e. 56.36percent of the total cases during the survey while as diarrhea constitutes 24.36percent Hepatitis-A 10.90percentandenteric fever 8.36percent.

Table 1.2. Deviation of water sample parameters from admissible limits of WHO, BIS Standards

Parameters	BIS	WHO	A	B	C	D	E	F	G	H	I	J	K	L	M
PH	8.5	8.5	50	15	6	7.3	5	7.3	7.4	7.5	7.4	7.3	8	7.4	7
Hardness	300	200	7.3	7.23	694	102	310	90	110	80	180	81.8	430	108	110
Alkanity	200	200	50	70	220	58	366	84	62	20	50	20	360	102	54
Calcium	200	200	20	76	100	56	326	66	66	20	60	80	400	56	62
Turbidity	10	10	167	12.04	0.28	23.4	0.35	17.7	23.4	81.1	14.13	39.4	0.61	17.67	12.10
Total dissolved Solids	2000	1000	37.87	89.6	758.1	96.7	43.82	108.5	98	69.72	104.51	80.5	516	137.83	106.4
Electric conductivity	600	600	54.1	128	1083	138	62.6	155	140	99.6	149.3	115	738	196.9	152
Dissolved Oxygen	5	5	5	6.5	0.5	2.4	0.7	1	2	4	2	3	1	5	4.7
BOD	2	2	1	1.2	1.3	1.5	1.4	1.5	1.4	1.5	1.4	1.4	1.5	1.4	1
Chlorine	250	250	30	30	30	30	50	30	30	30	40	30	30	40	30
Color	10	5	50	15	5	20	25	25	20	20	5	50	5	20	5
Iron	1	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphate	1	1	0.6	0	0	0	0.6	0.6	0.6	0	0	0	0	0	0
Fluoride	1.5	1.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Nitrate	45	45	0	0	10	0	0.5	0	0	0	0	0	10	10	10
Sulphate	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200

Source: *Computed from WHO and BIS Standards*

Table 1.3. Prevalence of Waterborne diseases in Sopore Tehsil

Year	Acute diarrheal	Percentage of acute diarrheal	Hepatitis A	Percentage of Hepatitis	Enteric fever	Percentage of enteric fever
2012	4725	19.07	0	0	571	38.34
2013	11623	46.91	87	32.34	314	21.08
2014	8426	34.01	182	67.65	604	40.56
Total	24774	100	269	100	1489	100

Source*: Sub-District Hospital Sopore (J&K)*

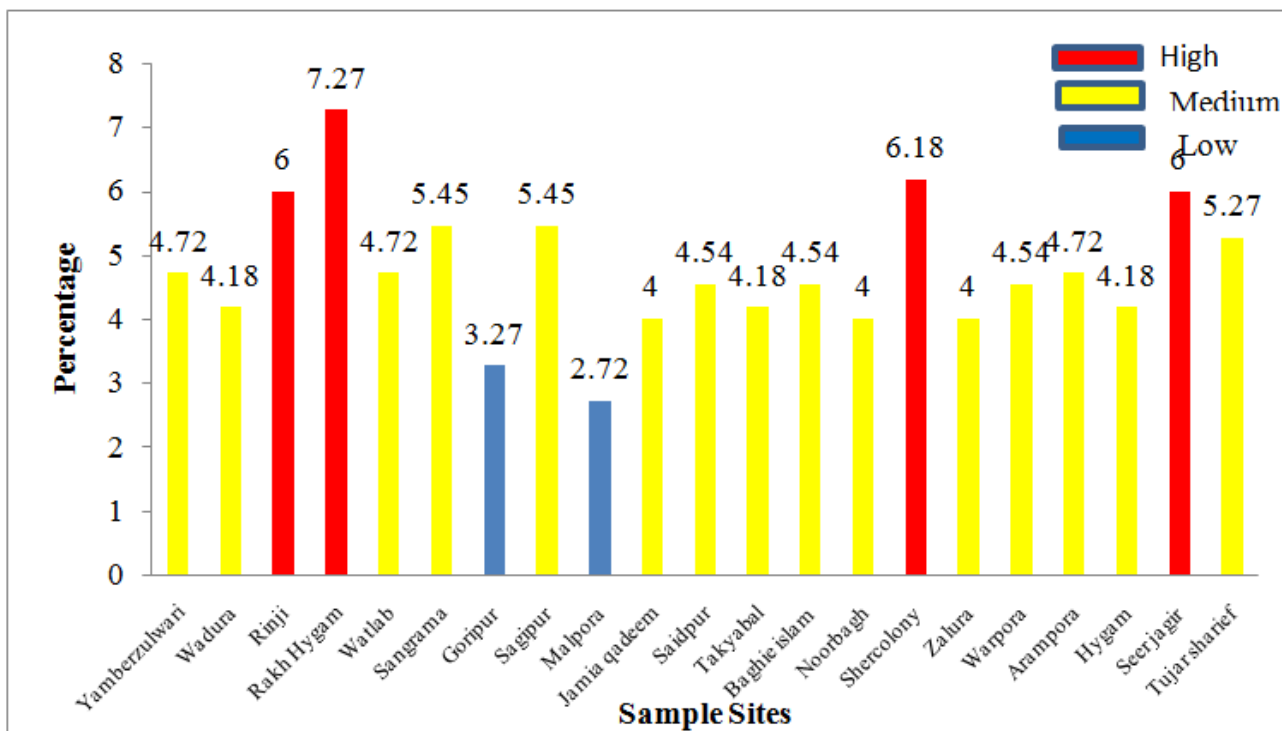**Table 1. 4. Prevalence of Waterborne Diseases in Sample Sites**

Villages/ wards	No. of households	Total population	Diarrhea	Hepatitis A	Enteric fever	Other	Total (%)
Yamberzulwari	24	73	5	3	4	14	26 (4.72)
Wadura	24	71	5	3	2	13	23 (4.18)
Rinji	24	92	9	4	2	18	33 (6)
Rakh Hygam	24	82	16	6	3	15	40(7.27)
Watlab	24	84	6	5	2	13	26 (4.72)
Sangrama	24	78	9	2	3	16	30(5.45)
Goripur	24	72	4	1	2	11	18 (3.27)
Sagipur	23	70	5	3	5	17	30 (5.45)
Malpora	23	84	2	2	0	11	15 (2.72)
Jamia qadeem	24	80	4	1	0	17	22 (4)
Saidpur	22	67	4	3	4	14	25(4.54)
Takyabal	22	72	8	3	0	12	23 (4.18)
Baghie islam	22	73	4	1	2	18	25 (4.54)
Noorbagh	22	77	0	0	0	22	22(4)
Shercolony	22	84	10	5	2	17	34(6.18)
Zalura	23	77	4	1	2	15	22(4)
Warpora	23	85	6	3	3	13	25(4.54)
Arampora	22	82	7	5	3	11	26(4.72)
Hygam	28	92	8	3	0	12	23(4.18)
Seer jagir	28	88	11	6	2	14	33(6)
Tujar sharief	28	95	7	0	5	17	29(5.27)
Total	500	1678	134 (24.36)	60 (10.90)	46 (8.36)	310 (56.36)	550

Source: Based on Field Study, 2014

The rural areas Rinji, Rakh Hygam and Seer Jagir were found to be more susceptible to waterborne diseases as water quality in these areas were not admissible for drinking and 19.27 percent of the total cases were recorded in these sites. While inurbanareas lack of drinking water quality was found in Sher colony, Noor Baghand other few areas which were also found more susceptible to waterborne diseases. The below figure shows the prevalence of waterborne diseases in sample sites which are categorized into High (6-8 percent), Medium (4-5.99 percent) and Low (2-3.99 percent).

Suspected Areas

Map shows the vulnerable areas to waterborne diseases in study site with degree of intensity. Red dots represent the areas highly vulnerable to waterborne diseases, yellow dots represents the areas with medium intensity and green dots with low intensity of waterborne diseases of the study site using different drinking water schemes. The other dots represents the overall settlement of the site including wards of the town, inner polygons represent the areas falling in drinking water schemes.

Source: *Based on Field Study, 2014*

Graph C. Prevalence of waterborne diseases in selected areas (village/ward wise)
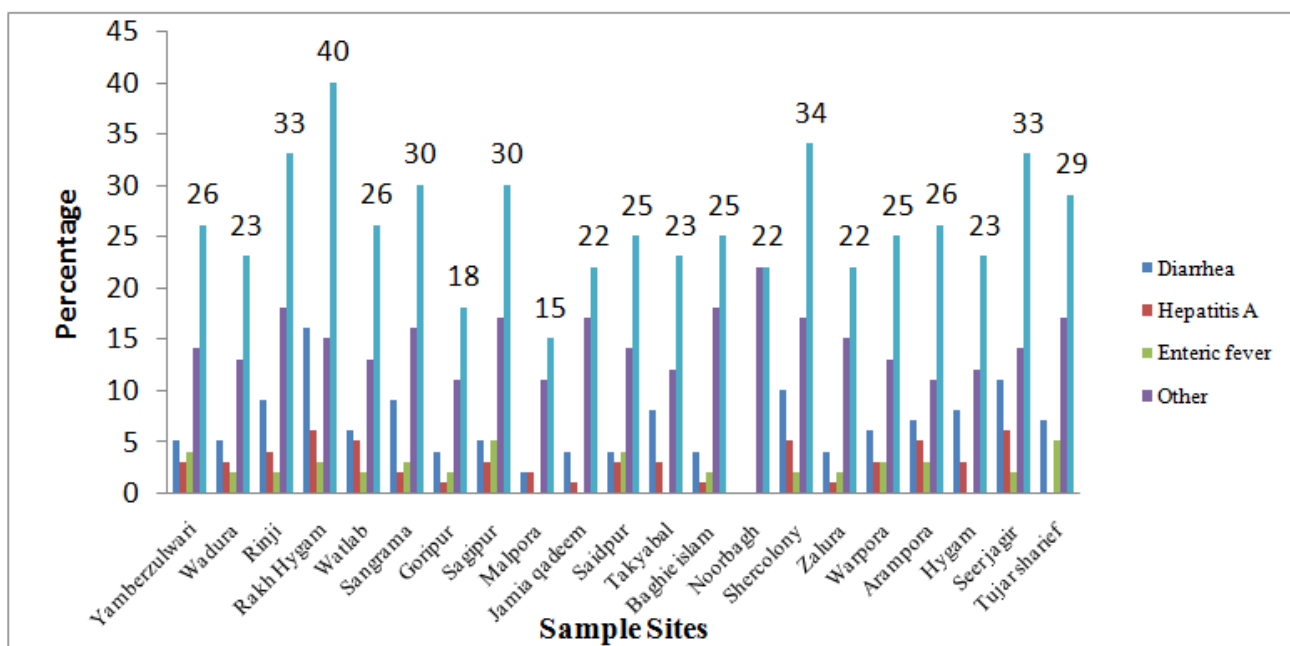

Source: *Based on Field Study, 2014*

Graph D. Distribution of waterborne diseases (by type) in study sites (2014)

The map has been generated in arc GIS environment in order to have overall picture of the sopore tehsil regarding water quality assessment and its impact on human population of the area.

Conclusion

The study reveals the quality of drinking water from various sources as deteriorated and at various sites as highly contaminated and not recommended for drinking purpose as per WHO or BIS standards. Although in some rural areas of the study sites water quality was found suitable for drinking and other purposes such as tujar water scheme and khawj sahib shia water scheme. PHE Department of area has only two water filtration plants which provides water only to the main town, while as major rural areas of the study area have been supplied unfiltered water.
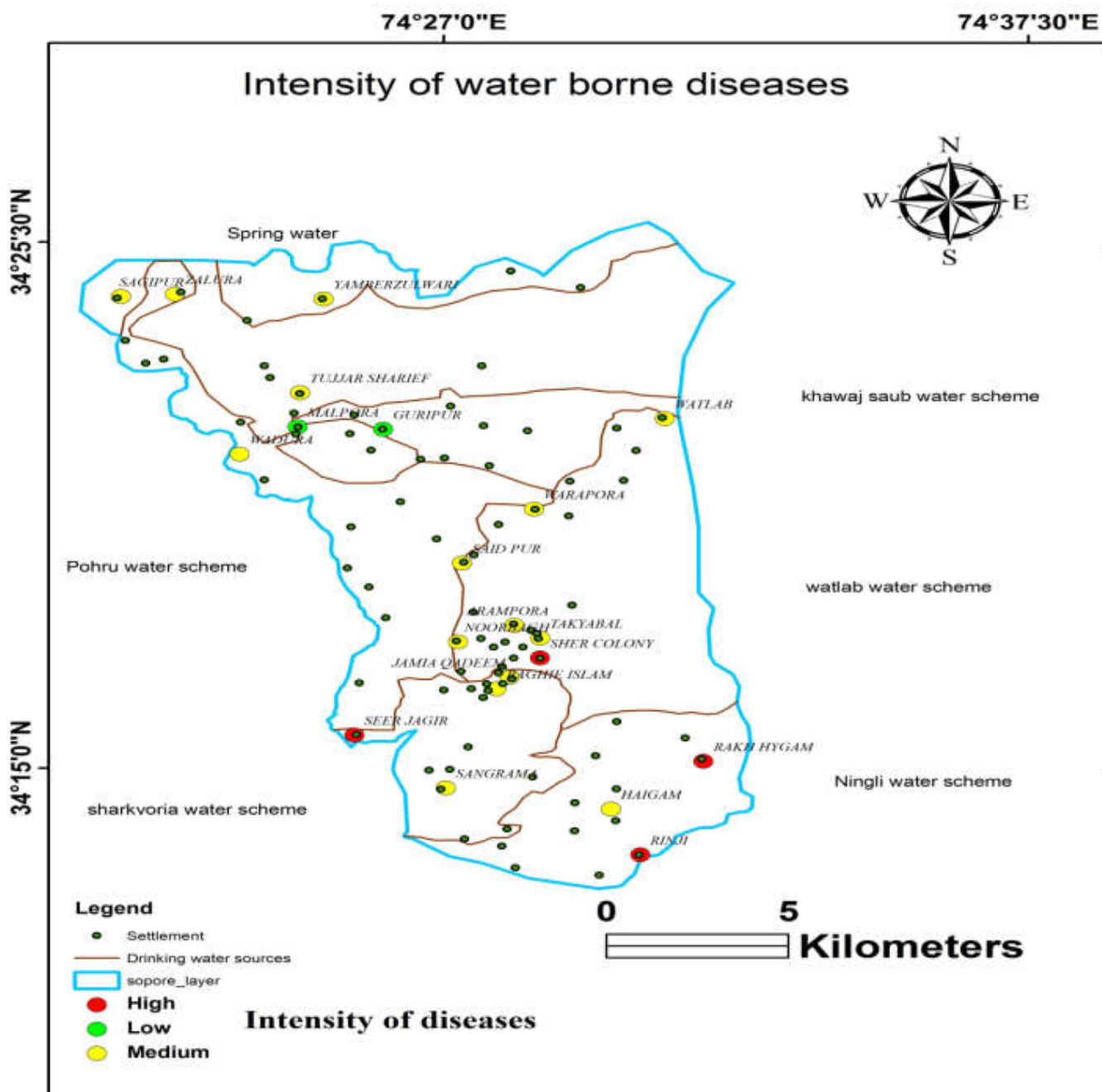
Source: *J & K Topo sheet 1961& Municipal town Sopore*

Fig. G. Intensity of waterborne diseases

Besides the quality there is an inadequate supply of potable water in whole tehsil which forces the people to fetch water from any untreated or which is not suitable for drinking or other basic purposes and its ill impacts were seen on the human health. During the field survey various waterborne diseases were recorded such as Diarrhea, Hepatitis, Enteric fever and other water related diseases and were computed with the secondary report from sub- district hospital sopore which is an alarming issue and misery to overlook as it will result the worst outbreak if unseen. Especially the highly susceptible areas such Rakh Hygam, Seer jagir, Rinji, Shercolony and Noorbagh (Momina Abad), where water was found contaminated and not fit to drink.

If necessary measures are not taken urgently the consequences will be very much disliking. The total cases recorded in the sub-district hospital related to waterborne diseases at study site from year 2012-2014 were 26532. Acute diarrhea cases constitute 24774 (93.37 percent), Hepatitis A 269 (1.01percent), and enteric fever 1489(5.61percent). The figure might be quite high as many of cases are not recorded due people perception to visit private clinics in their locality and other many factors. Also during the field survey 550 cases were recorded from the selected 500 households of selected villages/wards. Where in total acute diarrheal cases were found 24.36perecent, Hepatitis A (10.90percent), enteric fever (8.36perecnt) while as others (56.36 percent) which include dermatitis, conjunctivitis, irritated bowl, gastro intestinal, hair

loss, etc. The most cases from the selected sites in rural areas were found in Rakh Hygam, Seer Jagir, and Rinji while as in urban areas the highly affected areas were Shercolony, Noorbagh (Momina Abad) where water was not suitable for drinking and other purposes. Besides these selected sites there are other hotspot areas in rural as well as urban area which are adversely affected by inadequate supply as well as quality of drinking water. The worst part of these disease were also seen from the attitude of people and lack of awareness i.e. 50 percent of the total 500 households were consuming water direct without boiling or any proper filtration they wait impurity in water to settle down at the bottom and then use for various purposes which is not a sensible way and putting themselves in huge health risks.

Suggestions

The research study on Sopore Tehsil reveals varying prevalence and incidence rate of water borne disease. Therefore in the first place vulnerability to water borne diseases at community level needs to be made in order to understand the magnitude of ill health conditions of the people.

➢ Protection of water bodies and water resources arrests concern of general masses which can be achieved only through enforcing water protection Laws in the study area.
➢ Inadequate supply of portable water leads to compound human health problems therefore it is responsibility of the state to provide this basic amenity to all areas of the study area as government is constitutionally bound to safeguard people from any type of hazard.
➢ Mass awareness programmes regarding the benefits of safe drinking needs to Organize at panchayat level in the study area.

REFERENCES

National Environment Research Council, 2007. The Oceans: Scientific Certainties and uncertainties.Swindon, England.

Gunther, F. *et al*., 2006. Assessing waterborne risks: an introduction. *Journal of water and health*.

Sarkar, R. 2007. Epidemiological investigation of an outbreak of acute diarrheal diseases using geographic information systems. *Trans R SOC Trop Med Hyg.,* 101(6):587.93.

Alberini, A. *et al*. 1996. Determinants of Diarrheal Disease in Jakarta. *Water Resources Research,* 32(7): 2259-2269.

Rathar, G.M. *et al*. 2010. Impact of urban waste of Srinagar city on the quality of water of river jehlum. *International Journal of lakes and river,* Vol10 (3).

UNICEF, 2006. A report on water sanitation and Hygiene: Essential Elements of a child survival strategy.

World Health Organization, 2004. Water sanitation and hygiene links to health facts and figures. WHO, Geneva.

Bern, C. *et al*. 1992. The magnitude of the global problem of acute diarrheal disease: a ten-Year update. *Bull World Health Organ.* 70:705714.

Briscoe, J. 1978. The role of water supply in improving health in poor countries (with special reference to Bangladesh). *Am J Clin.,* 31: 2100-2113.

Rather, G.M. *et al*. 2014. Spring Water Quality and Human Health in Foothill Settlements of Pir Panjal Range in Anantnag and Kulgam Districts of Jammu and Kashmir State, India. Springer, Environment, deterioration and human health.

Ganpati, M. 2003. India's burden of waterborne diseases is underestimated. BMJ, 326(7402): 1284.

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