P: ISSN No. 0976-8602 RNI No.UPENG/2012/42622 VOL.-8, ISSUE-1, January 2019

E: ISSN No. 2349-9443 Asian Resonance

Hydrochemistry Types of Groundwater of Town Deeg (Bharatpur) Rajasthan: Correlation with Adverse Health Effects and Control Measures

Sunder Singh
Assistant professor,
Hydrobiology and Toxicology Lab,
Deptt. of Zoology,
M.S.J Govt. (P.G.) College,
Bharatpur, Rajasthan
India

Abstract

The Hydro chemical of groundwater was carried out in town Deeg (Bharatpur) Rajasthan, India, with an objective of understanding the suitability of local groundwater quality for domestic and irrigation purposes. Groundwater samples have been collected from different villages within town Deeg area. The objective of the present study is to create reference database to support management and conservation strategies. The investigation deals with the evaluation of ground water chemistry of town Deeg (Bharatpur), Rajasthan during months from (October, 2017 to November, 2018) season to find out pH, T.D.S., T.H., CaH, Total Alkalinity, F, Cl, Dissolved Oxygen (DO), Phosphorus, Nitrate, Salinity and comparison with BIS standards shows that TDS, TH, salinity, chloride, nitrate, and fluoride (all water) and CaH (hand pump) exceeded permissible limits. DO and phosphorus are within the limits. . Water borne diseases such as of heart, respiratory, gastric, diarrhea, jaundice, amoebiosis, arthritis etc. are prevalent in the area. The groundwater (well and hand pump) of Deeg (Bharatpur) is not fit for drinking purpose. Management strategies such as recharging ground water, registration and regulation of groundwater extraction, collection and disposal of domestic waste, de-fluoridation (food rich in calcium and phosphorus, adoption of an activated alumina adsorption technique), nitrate removal (use of yellow mustard and food with vitamin-C) and awareness of public about the water quality importance and hygienic conditions may be employed. . Hence, my findings strongly suggest that all the abstracted groundwater samples from the study area were not suitable for irrigation. Results of analyses for physical and chemical parameters of groundwater in this area was found to be exceed the desirable Bureau of Indian Standards and World Health Organization limits for drinking water.

Keywords: Town Deeg (Bharatpur) Rajasthan India, Hydrochemistry, Physico-chemical Parameters, Human Health, Control Measures.

Introduction

Fresh water is finite resource, essential for agriculture, industry and even human existence, without fresh water of adequate quantity and quality, sustainable development will not be possible[1]. Water is very essential for the survival of life because it maintains the homeostasis of the body of the living organisms. Various natural processes and human activities influence the environmental conditions of aquatic ecosystems which in turn influence the occurrence, abundance and adaptability of the biotic community[2]. Fresh water resource is becoming day-by-day at the faster rate of deterioration of the water quality is now a global problem[3].Major cause for water quality degradation by pollution of water bodies with substance , mix the aquifer by over pumping and Discharge of toxic chemicals,[4]. In India, where groundwater is used intensively for irrigation and industrial purposes, a variety of land and water based human activities are causing pollution of this precious resource [5]. Although water may be available in adequate quantities, its unsuitable quality limits the uses that can be made of it. Although the natural ecosystem is in harmony with natural water quality, any significant changes in water quality will usually be disruptive to the ecosystem [6]. The effects of human activities on water quality are both widespread and varied in the degree to which they disrupt the ecosystem and/or restrict water use[7,8].

In india ground water are naturally high in carbonates (hardness), thus necessitating their treatment before use for certain industrial applications in very large areas. Ground waters in some regions contain specific ions (such as nitrate, sulphate and fluoride) and toxic in quantities that are harmful to health while others contain elements or compounds that cause other types or problems . Nitrate pollution is an important aspect of environmental problems. Due to rapid industrialization, artificial fertilizer activity in agriculture, urbanization, unsecured sanitation and irrigation of fields by sewage effluent since independence, the possibility of nitrate pollution increases. Nitrate is considered as a second most common pollutant of ground water next to pesticides. Nitrate is a natural constituent of plants and is found in vegetables at varying levels depending on the amount of fertilizer applied and on other growing conditions.

Chemical oxygen demand is the amount of oxygen, consumed under specific conditions in the oxidation of both biological and biologically inert organic matter by strong oxidizing chemical reagents. BOD is measured as the volume of oxygen required by bacteria to metabolise organic matters under aerobic condition. The microbial biomass and photosynthetic and heterotrophic components in a water body show a direct impact on BOD levels. Increased organic matter results the excess oxidation of organic material to carbon dioxide and the water creates an atmosphere of oxygen depletion and results for high BOD levels. The high levels of BOD are not easily reversed and an anaerobic foul in the water body is created which will not support fish and other oxygen requiring organisms. The highest values of BOD in pond water may be due to the inflow of domestic sewage, deposition of large heaps at the bank of the ponds and anthropogenic activities which result in an increase in organic matter in the water body. Increase in the BOD may also be due to nutrient loading in the water body which promotes toxic algal bloom leading to destabilization of the aquatic ecosystem. In any lotic system, the nature and abundance of planktons, its quality and seasonal distribution are mainly determined by physical and chemical features The phytoplankton serves as the producers in the food chain in the aquatic ecosystem and the productivity depends upon the quality of water.

Bacterial population (number of *E. coli*) is often considered as an important indicator of pollution and eutrophication in an aquatic ecosystem. Coliform bacteria have long been used as an indicator of human contamination of potable and receiving water[9, 10]. The bacteriological examination of water has a special significance in pollution studies, as it is a direct measurement of deleterious effects of pollution on human health. The great danger to health is the presence of excremental bacteria as contaminated water may cover the causative organisms of diseases.

Materials and Methods

Deeg a town of heritage due to historical values and world famous JalMahal , gardens, forts and fountains, is located at 27°28' N latitude and 77°20' E longitude with an average elevation of 174m (571 ft.) in district Bharatpur (popular for bird sanctuary– the Keoladeo Ghana National Park), Rajasthan, India. Deeg comes under the big "Parikramamarg" of Lord Krishna starting from Goverdhan (Mathura), U.P., at a distance of 32 kms. north from Bharatpur, 153 kms. south-west from Delhi and 98 kms. north from Agra (U.P.) within the territorial limits of the ancient holy Braj Bhumi. The Deeg land filling dumpsite is in the beginning of Kaman road by 200 feet road. Deeg Land filling dumpsite is surrounded by residential areas in which they are heavily affected by both soil and water pollution through the leach out of hazards from the solid waste.In town Deeg there are different sources of drinking water such as hand pumps, open wells, PHED water supply and open pond water. Four different areas the JalMahal, Goverdhan road, Kaman road and Nagar road and their nearby places of town Deeg were selected for sampling of water. The approximate distance between the four areas was one and a half kilometer. Samples were taken from all the four areas including four samples each from hand pump and well water every fortnightly during months from season from (October,2017 to November, 2018). Samples were taken in clean sterilized polythene bags. Water samples were analysed to find out pH, Total alkalinity, Total hardness (TH), Calcium hardness (CaH), Nitrate (NO_3), Total dissolved solids (TDS), Phosphorus (P), Fluoride (F), Salinity, Chloride, Dissolved Oxygen (DO) and *E coli* by using methods as given [11,12]. pH of the samples was analysed at the spot and compared with standard method[13].

Results and Discussions

The result obtained and average value of each parameter with standard error is presented in table 1. The pH of all water samples of all areas is within the permissible limits. The TDS and TH of all the hand pump and well water of all areas are higher to the permissible limits in the present studies. The high TDS may be due to ground water pollution by waste water which is discharged into pits and deposition of large heaps of cattles and human wastes around the well of town in the present studies.The present findings are in agreement to different authors[14,14a,15,16,17].

The higher values of CaH in the water of hand pump has been noted in the present studies which may be due to the addition of calcium ions to a natural water system as it passes through soils and rocks containing large amounts of calcium in mineral deposits [18]. The total alkalinity in hand pump water of Goverdhan road exceeds the permissible limits. The dissolved oxygen and phosphorus are within the prescribed limits. Very high salinity in the ground water may be due to a combination of low rainfall and high evaporation. The values of chloride in well and hand pump water (except JalMahal) of all four areas exceeds permissible limits [19,20].

The fluoride content of all areas (except hand pump of Goverdhan road and jalmahal)

exceeds far from prescribed limits which may be due to natural phenomenon, influenced by the local and regional geological setting and hydro geological conditions. Further, aridity of climate, dissolution of F bearing minerals, ion exchange and evaporative concentrations may locally reasoned for high fluoride in ground water[21]. High fluoride contents in groundwater of town Deeg[22]. Presence of fluoride above permissible limit in most of the sources of drinking water is the concern of public health and have serious health consequences[23]. In the surveyed area it is evident that children and older people are affected by teeth molting, teeth coloring, dental and skeletal fluorosis, weakness, neurological problem, damage brain development), gastrointestinal problems, urine trouble, abnormal behavior, reduction of IQ etc.[24,25] in the area by taking fluoride contaminated water.

The Nitrate concentration in all areas is higher than the permissible limits which may be attributed to the percolating nitrate from decaying plants and animal material, agricultural fertilizer, industrial and sewage waste into dugwells during rainfall and plantation of leguminosae crops which fix atmospheric nitrogen in the form of nitrate. This may create serious health problems such as methamoglobinemia (blue baby) in infants and pregnant women, gastric cancer, acute respiratory tract infection due to the formation of carcinogenic nitrosamine and nitrosarcosine, if used for drinking purpose[26]. The reason being nitrite (NO_2) in the human intestine combines with haemoglobin making it ineffective to absorb oxygen.The high concentration of Nitrate (NO_3) in ground water [27,28,29,30]. In the present study the *E coli* was 2000 to 2500/100 ml in well water indicating the chance of pathogenicity and not fit for drinking without treatment and gain support by some authors who investigated bacterial contaminations of well water[31,32,33,34,35].

Conclusion

The main objective of the present investigations is to assess and identify the quality of water in town Deeg (Bharatpur) Rajasthan, which have been used for drinking as well as for other domestic purposes for a long time. The study definitely will result in evolution of some cheap technology or alternative method to improve the water quality. Therefore the present investigation has been undertaken to analyse the physico–chemical and biological properties of water, its health effects in human population and the probable remedies to get rid off these problems. It has been concluded that water of town Deeg (Bharatpur) not within the desirable limits, so not suitable for drinking and another uses.

Management and conservation measures must be implemented to improve the water quality. The further study such as the estimation of trace elements (As, Zn, Iron,) and pesticides will definitely be fruitful in improving the potability of water in town Deeg (Bharatpur). From the present study it is evident that ground water quality is gradually getting deteriorated and it may deteriorate further with time. The water quality of well and hand pump of all areas are polluted and unfit for human consumption f,or any use. People may suffer through disease on drinking water with higher concentration of toxic chemicals[36,37,38].They may have physiological effects as on kidney, digestive system, circulatory system, nervous system etc. various other organs and various systems of the body.

Strategies of Control Measures of Pollution in Groundwater

1. The ground water drawn from hand pumps should be properly chlorinated to eradicate the presence of bacterial contamination.
2. For the conservation and management of water resources the traditional methods such as recharging water system by ponds, pokhars and reservoirs and rain water harvesting must be employed
3. Groundwater extraction structures (tube well, hand pump, deep bore, and well) should be registered and regulated.to decrease over-abstraction and degradation of ground water quality.
4. The groundwater must be assessed before use to ensure suitability of the quality for human consumption.
5. The ground water sources and their surroundings should be maintained to ensure hygienic conditions and no sewage or polluted water should be allowed to percolate directly to ground water aquifer.
6. The hand pumps, of very poor water quality should be painted red to indicate and warn the public that the water drawn from the source is not fit for human consumption.
7. The untreated sewage and sewerage flowing in various open drains are one of the causes of ground water quality deterioration. Proper underground sewerage system must be laid in all inhabited areas and the untreated sewage and industrial wastes should not be allowed to flow in open drains.
8. Monitoring of Groundwater quality should be done in the areas where water was found contaminated.
9. Collection & treatment of wastewater and collection & disposal of municipal solid waste must be executed.
10. Industries should not be allowed in residential areas. There should be no stagnation of wastewater to prevent percolation of pollutants in groundwater.
11. Disposal of hazardous waste or biomedical waste should be prohibited in the city limit to avoid any leaching process in to the groundwater.
12. The drinking water quality in an emergency situation at household-level can be monitored by the rolling boil than cooling and alum or bleaching treatment before use to minimize the concentration of TDS .
13. The de-fluoridation treatment (domestic level) should be undertaken if the water is having high fluoride.
14. The use of potable water with high fluoride concentration should be discouraged. Food rich

in calcium and phosphorus, adoption of an activated alumina adsorption technique, recharging the underground aquifer by harvesting, are recommended as these decreases the fluoride accumulation in human body.

15. Treatment option for nitrate should be undertaken in ground water drawn from sources exceeding the permissible limit of 50 mg/L.
16. Nitrates must not be removed by boiling as this will concentrate the nitrates making levels high. Yellow mustard is effective for the removal of nitrate.
17. Use of canned milk and food to children should be banned in the areas with high nitrate.Vitamin-C with food should be provided because it develops immunity to nitrates.
18. Environmental awareness through education is highly recommended as this is very important to conserve water resources and equally to maintain health.

Endnotes

1. *Brown, J., Bach L.,Aldous, A.and Wyers, A. (2007). Overcoming data shortfalls to locate ground water dependent ecosystems and assess threats to ground water quantity and quality. In : L. Ribiero, A. Chambel, and M.T. Condesso de Melo (Eds.). Proceedings of the 35th IAH Congress International Association of hydrogeologists groundwater and ecosystems. Lisbon, September 2007,17-21, Pp-461.*
2. *Roy, R. (2009). Evaluation of fluoride affected area in raisen district M.P.and preventionary step to get safe potable water. Proc. of National seminar on science,.education .and attraction of talent for excellence in research., 21-22Feb.2009.*
3. *Singh, S. (2014). Assessment of Fluoride content, PH and TDS in potable water of town Deeg (Bharatpur): an environmental concern. International refereed research journal "PRAMANA." 3(13), 113-119.*
4. *Gupta, B.K. and Verma, S. S.(2007). Physicochemical studies of drinking water quality of town Deeg (Bharatpur) Rajasthan during pre-monsoon season. Proc. of National Symposium of Limnology held at Udaipur (19-21 Feb. 2007).pp. 224-226.*
5. *Garg, D.,Kaur, R., chand, D.Mehala, S. K.and Singh, R. V. (2008). Analysis of water quality of Bharatpur (Rajasthan) area in post monsoon season, January 2007.Rasayan Journal of chemistry.1 (4) :743-750.*
6. *Tyagi, P. D,,Buddhi, C.R. and Sawhney, R. L.(2002). Degradation of ground water quality in industrial areas of India – A review.Indian Journal of Environmental Protection. 3(20), 174-181.*
7. *Eamus, D., Froend, R.,Loomes, R., Hose, G. and Murray, B. (2006). A functional methodology for determining the groundwater regime needed to maintain the health of groundwater dependent vegetation. Australian Journal of Botany.54(3) 97-114.*
8. *Banpurkar, A. R. and Bhandarkar, S. E. (2008). Study of potability of water of different sources located at Bhadrwati, Chandrapur (M.S.). Inernational Journal of chemical sciences 6 (2) 676–680.*
9. *Gupta, B. K.and Sharma, A. (2009).Assessment of water quality of vimalkund, town Kaman district Bharatpur, Rajasthan (India. Journal of Pollution Research, 28(4) 581-583.*
10. *Gupta, B. K. and Jatav, B, P, (2009). Physicochemical Characteristics of Water of Juggar Dam, Hindaun city in Karauli District Rajasthan. Proceedings of National Conference on Environmental Health Hazards, December 17 – 18, 2009, held at JDB Girls College, Kota (Rajasthan).pp 293 – 294.*
11. *APHA, AWWA and WEF (2005).Standard Methods for the Examination of Water and Wastewater. 20Edn. American Public Health Association, American Water Works Association and Water Environmental Federation, Washington, DC, United States.*
12. *Trivedy, R. K.and Goyal, P. K.(1986). Chemical and biological methods for water pollution s studies.Environ.publication, Karad.*
13. *BIS. (1991). Indian standard specification for drinking water, Bureau of Indian Standards, New Delhi, IS: 10500.*
14. *Singh, S. (2013). Quality status of drinking water of town deeg, distt. Bharatpur, Rajasthan: A physico-chemical analysis and health effect with mitigation measures proceeding of national conference on forest and wild life; present status,future needs and challenges ahead on 30-31 jan.2013 held at Bharatpur, Rajasthan . pp.09.*
15. *Singh, S. (2014a). Physical, Chemical and Microbiological properties of ground water of town Deeg (Bharatpur) Rajasthan : A case study. International refereed indexed & listed research journal "HINDU. 1(4), 205-210.*
16. *Singh, S. (2014b). Assessment of Bio-Physico and chemical and Microbiological Characteristics and suitability of ground water of town Deeg (Bharatpur) Rajasthan: an Environmental concern. International refereed peer reviewed research journal PERIODIC RESEARCH".3(1), 92-96.*
17. *Singh, S. (2014c).Hydrochemical Monitoring of ground water quality with reference to town deeg, district Bharatpur, Rajasthan. International refereed peer reviewed research journal "ASIAN RESONANCE". 3(4), 93-97.*
18. *Renn. C. E. (1970). Investigating water problems. Educational Products division, La Molte chemical products company, Maryland.*
19. *Shivakar, M.M., Patil C L and Waikole V (2009). Assessment of well water quality in and around Dombivili region (Thane, India).Journal Pollution Research. 28 (2), 301-304.*
20. *Sampat, P. (2000). Deep Trouble: The hidden threat of groundwater pollution. World Watch Paper # 154.World Watch Institute, pp.-28.*
21. *Saxena, V.K. and Ahmed, S. (2003).Inferring the chemical parameters for the dissolution of fluoride in groundwater.Journal Environmental Geology. 4(43) 731-736.*

22. *Madhnure, P.Sirsikar, D. Y.,Tiwari, A. N.,Ranjan, B.andMalpe, D. B.(2007). Occurrence of fluoride in the ground waters of Peindharkawada area, Yavatmal (M.S.).Current Science. 92(5), 675–679.*
23. *WHO (World Health Organization), (2008).Guidelines for Drinking Water Quality.Recommendation, World Health Organization, Genewa, Vol. I. pp. 130-135.*
24. *Emmanuel, K., Ramaraju, A. K. A., Rambabu, G.and Veerabhadra, R. A. (2008).Removel of fluoride from drinking water with activated carbons prepared from HNO3 activation-Acomparative study. Rasayan journal of Chemistry.1 (4) : 802-818.*
25. *Roy, S.K. (2007).Physico-chemical and biogenic pollution studies of ground water and related environmental impact assessment of the district of Bankura, West Bengal. Journal of Environment and Sociobiology.4(1) 31-36.*
26. *Uba, B. N. and Aghogho (2001).Rain water quality from different roof catchments in Port-Harcourt district. Institute Public Analyst of Nigeria News, 2,pp. 11-14.*
27. *Kannan, V.,Ramesh, R. and Kumar, C. S. (2005). Study on ground water characteristics and the effects of discharged effluents from textile units at Karur, Tamilnadu. Journal Environmental Biology. 26(2), 269–272.*
28. *Prakash, K. L.and Somashekar, R. K.(2006). Ground water quality assessment on Anekal Taluk, Bangalore urban district. Indian Journal of Environmental Biology. 27(4), 633–637.*
29. *Kumar, S., Gupta, R. K.and Gorani, A. C. (2008). Nitrate Pollution in dug well water of Putki–Balihari Colliery area of Dhanbad district (Jharkhand). Asian Journal of Experimental Sciences. 22(1), 161–164.*
30. *Bathej, K.Sinha, A. K. and Seth, G.(2009). Studies on water treatment for removal of nitrate. Asian Journal of Experimental Sciences 23 (1): 61-66.*
31. *31.Gupta, B. K.and Singh, S. (2009). Ground Water Quality of Town Deeg in District Bharatpur, Rajasthan, India : A physicochemical analysis. Proceedings of National Conference on Environmental Health Hazards, December 17 – 18, 2009, held at JDB Girls College, Kota (Rajasthan). pp. 296 – 297.*
32. *Gupta, B. K.and Singh, S. (2010). Physicochemical Assessment of Drinking Water of Town Deeg (Bharatpur), Rajasthan during Monsoon season. Journal Life Science Bulletin. 7(01),155-157.*
33. *Gupta, B. K.and Singh, S. (2011). Nitrate and Fluoride in ground water of town Deeg (Bharatpur) Rajasthan: An assessment related to seasonal changes. Journal Life Science Bulletin. 8(01), 231-234.*
34. *Singh, S. and Jatav, P. L. (2016).Environmental pollution: A threat to life and its remedies.Proceeding of National conference on Environmental impact on health and its management: co-friendly strategies (NCEHM-2016) at Jaipur(Rajasthan) India on dated 08-10 Feb. 2016.PP.50.*
35. *Singh, S. and Gupta, B.K. (2016).Biodegradation and bioremediation of pollutant: perspective studies and applications. International Journal of Pharmacology and Biological Sciences. 10(1), 53-65.*
36. *Singh, S. (2015). Water Pollution and its Impact on the Human Health in Town Deeg (Bharatpur) Rajasthan: Correlation with Hydrochemical Characteristics. Proceeding of National conference on Environmental pollution, health hazards and prevention (NCEPHHP-2015 At Bharatpur, Rajasthan, India on dated 11-12 Dec.2015.pp.154.*
37. *Singh, S.(2016). The role of biotechnology on the treatment of wastes. Proceeding of International conference on Biotechnology and Nanotechnology (ICBN-2016) at Jaipur (Raj.) India, on dated 30 Jan. -01 Feb. 2016. PP.36.*
38. *Bisi-Johnson, Adediran, M.A., Akinola, K.A., Popoola, S.A, Okoh, E.O.(2017).Comparative physicochemical and microbiological qualities of source and stored household waters in some selected communities in* Southwestern Nigeria. Sustainability (9), 454

Table 1: Pysico-biochemical variables of ground water in Town Deeg (Bharatpur) Rajasthan.

Area	Type of water	pH	TDS (ppm)	Total alkalinity (ppm)	TH (ppm)	CaH (ppm)	Chloride (ppm)	DO (ppm)	Salinity µs/cm	P (ppm)	Nitrate (ppm)	F (ppm)	*E coli*/ 100ml
Nagar Road	Hand pump	7.07 ±.007	6769 ±8.27	388 ±4.79	4820 ±8.16	612 ±2.8	3337 ±28.98	4.79 ±0.03	9942 ±26.68	.06 ±0.002	125.50 ±0.98	3.56 ±0.05	00.00 ±0.00
	Well	7.58 ±.015	3529 ±4.27	119 ±1.25	2828 ±12.83	629 ±2.51	1906 ±16.96	6.53 ±0.02	4673 ±18.12	0.00 ±0.00	142.65 ±0.07	6.96 ±0.04	2500 ±13.46
Goverdhan Road	Hand pump	7.17 ±.018	3576 ±2.23	545 ±2.04	1845 ±15.54	1222 ±5.08	1665 ±22.69	4.75 ±0.06	4952 ±18.44	.03 ±0.00	115.25 ±0.38	1.20 ±0.018	8.00 ±0.06
	Well	7.15 ±.015	4673 ±2.38	746 ±2.39	2040 ±10.80	229 ±2.51	1984 ±4.33	3.95 ±0.03	6444 ±34.44	.10 ±.007	82.67 ±0.07	7.69 ±0.01	2220 ±24.32
Jal Mahal	Hand pump	7.05 ±.064	2589 ±4.27	216 ±2.39	2555 ±12.50	470 ±3.82	995 ±14.52	3.88 ±0.01	4060 ±14.46	0.00 ±0.00	115.25 ±0.38	0.76 ±0.04	00.00 ±0.00
	Well	7.40 ±.019	2176 ±2.39	390 ±4.08	2063 ±21.59	172 ±9.52	614 ±6.02	5.39 ±0.13	3141 ±13.24	.17 ±0.004	125.25 ±0.38	7.96 ±0.035	2000 ±19.83
Kaman Road	Hand pump	6.91 ±.016	8618 ±12.09	478 ±4.79	4470 ±28.86	455 ±5.08	3284 ±54.11	3.55 ±0.01	12645 ±34.44	.10 ±0.004	325.75 ±0.48	2.60 ±0.043	14.00 ±0.25
	Well	7.50 ±.017	8246 ±2.39	520 ±4.08	2375 ±47.87	235 ±6.65	4580 ±45.83	4.40 ±0.00	12110 ±43.48	0.00 ±0.00	142.65 ±0.07	8.61 ±0.054	2420 ±22.64
Permissible Limits(ppm) (BIS Standards)		6.5 To 8.5	500 To 2000	200 To 600	300 To 600	75 To 200	250 To 1000	3 To 7	0-1500	0.1 – No relax	45 – No relax	1.00 To 1.5	Less than 10.00

Values are Mean ± Standard Error