# MICROBIOLOGICAL EVALUATION OF GROUND WATER IN SOME TOWNS OF VELLORE DISTRICT, TAMIL NADU ,INDIA.

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**ABSTRACT**

**The aim of this study was to investigate microbiological quality of the ground water in some towns of vellore district. In this study, a total of 30 water samples were taken from bore-well. The microbial quality of gathered samples was determined based on standard methods in laboratory. Statistical analysis of the results was performed. Based on obtained results most of the samples were seriously contaminated to coliform and fecal coliform bacteria. The existing results revealed that water from bore wells are not safe for human use. The existence of indicator bacteria in high amounts indicates the probable presence of pathogenic bacteria. A widespread microbial contamination of water sources was observed necessitating better sanitary measures. So that it is necessary to disinfect the groundwater before human consumption.**

## 1.INTRODUCTION

Groundwater represents an important source of drinking water and its quality is currently threatened by a combination of over-abstraction and microbiological and chemical contamination [1, 2].

The most common and wide spread health risk associated with drinking water is its microbial contamination, the consequences of which are so serious that its control must always be of paramount importance. Microbiological quality should therefore be regarded as a priority, although it may be impossible to attain the targets in the short or medium term. Bacterial indicators are measured instead of pathogenic organisms, because the indicators are safe and can be measured with faster and less expensive methods than the pathogens of concern.

The quality of water is typically determined by monitoring microbial presence, especially Faecal Coliform bacteria (FC) and total coliform [3]. These parameters could be affected by external and internal factors. There is an intricate relationship between the external and internal factors in aquatic environments. Coliform bacteria are used as microbiologic indicators for water quality. Freedom from contamination with faecal matter is the important parameter of water quality because human faecal matter is generally considered to be a great risk to human health as it is more likely to contain human enteric pathogens [4].

## 2. Description of the study area

**Study Area**: The study area lies between Latitude N 12°52'30'' – 12°57'30'' and Longitude E 79°15'00''–79°25'00'' is located in North of TamilNadu in India, covering about 154.52 Sq.Km area (Fig.1). The area includes Ranipet, Walajapet, and Arcot . The drainage of the study area is mainly Palar River and Ponnai River. The Ranipet area is a chronic polluted area and one of the biggest exporting centers of tanned leather. Many small-scale tanneries are processing leather in the study area and discharging their effluents on the open land and surrounding water bodies [5].

Fig.1 **STUDY AREA MAP**


**ZONE-I**

**1.Shozhingar road**
**2.GH road**
**3.TNHP colony**
**4.Belliyappa Nagar**
**5. Kakithakar street**

**ZONE-II**

**6. Kalavai road**
**7. Arcot bus stand**
**8. Krishnapuram**
**9. Kaikara street**
**10.Dhandu bazzar**

**ZONE-III**

**11. Agrawaram 12. Ranipet bazzar 13. Ammour 14. Thendral Nagar 15. Maniyam pattu**
**16. New Agrawaram 17. Puliyankannu 18. Bharathi Nagar 19. Emorold Nagar 20. Karai**
**21. Vedagal 22. Periya thangal 23. Puliyanthangal 24. Navalpur 25. Chettithangal**
**26. Vanapadai 27. RV Nagar 28. Mettuthangal 29. Manthangal 30. Vanapdai road**

## 3.MATERIALS AND METHODS

### Collection of water samples

This study was carried out for three years from January 2014 to September 2016. A total of 30 samples were collected. For each water sample, 250 ml of water was collected in an autoclaved sterile glass container aseptically and transported to the laboratory in an icebox and processed within 3 hrs of its collection. Microbial studies were carried out by MPN method [6].

### Categories used for water quality assessment

The microbial content is a very important water quality parameter because of its bearing on human health. Water can be classified based on microbial quality as shown in table4.4.3; for human use safely.

**Table 1. Classification of water on microbial quality [7](DWAF, et al.2001).**

| Parameter | Good | Marginal | Poor |
|---|---|---|---|
| Total. Coliform | <10 cfu.100 ml-1 | 11-100 cfu.100 ml-1 | > 100 cfu.100 ml-1 |
| Faecal. Coliform | 0 cfu.100 ml | 1-10 cfu.100 ml-1 | > 10 cfu.100 ml-1 |

## 4. RESULTS AND DISCUSSION

**Table 2. Total coliform and Faecal coliform values of ground water for winter, summer and monsoon seasons 2014,2015 and 2016.**

| | 2014 | | | | | | 2015 | | | | | | 2016 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.NO | WINTER | | SUMMER | | MONSOON | | WINTER | | SUMMER | | MONSOON | | WINTER | | SUMMER | | MONSOON | |
| | TC | FC | TC | FC | TC | FC | TC | FC | TC | FC | TC | FC | TC | FC | TC | FC | TC | FC |
| S1 | 27 | 3 | 21 | 5 | 38 | 11 | 89 | 14 | 31 | 9 | 43 | 31 | 59 | 29 | 35 | 12 | 56 | 29 |
| S2 | 279 | 19 | 66 | 13 | 283 | 19 | 79 | 33 | 272.4 | 19 | 303 | 29 | 171 | 71 | 175.4 | 22 | 169 | 32 |
| S3 | 196 | 38 | 110 | 19 | 228 | 18 | 108 | 51 | 120 | 19 | 238 | 34 | 121 | 56 | 110 | 25 | 144 | 28 |
| S4 | 192 | 21 | 116 | 18 | 205 | 19 | 12 | 37 | 231 | 29 | 215 | 43 | 139 | 61 | 123 | 22 | 224 | 24 |
| S5 | 103 | 12 | 56 | 24 | 128 | 20 | 14 | 27 | 21 | 8 | 138 | 55 | 66 | 35 | 66 | 30 | 145 | 25 |
| S6 | 137 | 43 | 68 | 13 | 172 | 30 | 7 | 55 | 117 | 13 | 182 | 54 | 132 | 55 | 111 | 17 | 186 | 31 |
| S7 | 94 | 10 | 0 | 0 | 128 | 19 | 104 | 20 | 21 | 0 | 138 | 29 | 69 | 46 | 140 | 39 | 64 | 29 |
| S8 | 136 | 22 | 51 | 3 | 160 | 18 | 0 | 33 | 100 | 0 | 163 | 35 | 98 | 49 | 84.65 | 15 | 67 | 35 |
| S9 | 127 | 1 | 26 | 0 | 139 | 13 | 46 | 8 | 71 | 1 | 139 | 41 | 78 | 45 | 63.2 | 8 | 48 | 22 |
| S10 | 217 | 17 | 66 | 3 | 229 | 14 | 36 | 29 | 151 | 5 | 243 | 52 | 112 | 56 | 93 | 21 | 199 | 29 |
| S11 | 127 | 15 | 16 | 3 | 160 | 11 | 47 | 24 | 120 | 0 | 173 | 55 | 101 | 46 | 99.4 | 17 | 79 | 33 |
| S12 | 197 | 0 | 5 | 0 | 223 | 5 | 114 | 3 | 62 | 0 | 223 | 25 | 81 | 35 | 44 | 6 | 38 | 14 |
| S13 | 116 | 0 | 11 | 0 | 143 | 4 | 123 | 3 | 70 | 2 | 158 | 43 | 50 | 44 | 33 | 0 | 67 | 16 |
| S14 | 17 | 5 | 21 | 5 | 33 | 10 | 37 | 12 | 170 | 0 | 48 | 23 | 134 | 54 | 131 | 22 | 118 | 25 |
| S14 | 12 | 9 | 6 | 7 | 37 | 9 | 17 | 18 | 165 | 0 | 43 | 48 | 141 | 78 | 122 | 17 | 155 | 35 |
| S16 | 77 | 11 | 31 | 3 | 28 | 14 | 90 | 14 | 31 | 4 | 52 | 55 | 34 | 19 | 31 | 0 | 55 | 31 |
| S17 | 127 | 36 | 36 | 16 | 140 | 30 | 7 | 42 | 42 | 21 | 160 | 56 | 60 | 21 | 44 | 4 | 92 | 34 |
| S18 | 227 | 15 | 121 | 36 | 238 | 21 | 47 | 19 | 73 | 42 | 260 | 59 | 103 | 55 | 136 | 42 | 122 | 39 |
| S19 | 237 | 27 | 126 | 4 | 261 | 20 | 0 | 33 | 92 | 10 | 271 | 30 | 59 | 24 | 120 | 16 | 108 | 22 |
| S20 | 207 | 38 | 106 | 17 | 239 | 28 | 4 | 45 | 90 | 22 | 263 | 55 | 51 | 42 | 89 | 22 | 72 | 24 |
| S21 | 247 | 17 | 101 | 15 | 273 | 25 | 0 | 22 | 101 | 23 | 295 | 29 | 0 | 11 | 59 | 23 | 15 | 13 |
| S22 | 127 | 44 | 54 | 17 | 153 | 30 | 127 | 47 | 124 | 27 | 173 | 61 | 78 | 50 | 64 | 30 | 45 | 21 |
| S23 | 67 | 25 | 11 | 24 | 93 | 25 | 81 | 29 | 171 | 30 | 117 | 66 | 130 | 71 | 120 | 36 | 130 | 78 |
| S24 | 86 | 27 | 54 | 24 | 121 | 19 | 92 | 34 | 164 | 32 | 136 | 61 | 102 | 52 | 140 | 37 | 102 | 36 |
| S25 | 93 | 47 | 0 | 32 | 123 | 33 | 3 | 47 | 132 | 37 | 137 | 58 | 106 | 56 | 112 | 42 | 149 | 35 |
| S26 | 61 | 19 | 3 | 0 | 81 | 14 | 61 | 23 | 61.8 | 0 | 96 | 59 | 33 | 29 | 49 | 22 | 57 | 25 |
| S27 | 107 | 53 | 38.45 | 6 | 139 | 30 | 17 | 53 | 92 | 6 | 163 | 55 | 98 | 56 | 120 | 46 | 92 | 23 |
| S28 | 123 | 36 | 30.55 | 8 | 153 | 33 | 36 | 36 | 94 | 4 | 183 | 55 | 111 | 53 | 71 | 4 | 94 | 19 |
| S29 | 61 | 49 | 32 | 4 | 93 | 36 | 0 | 52 | 62 | 8 | 118 | 54 | 23 | 35 | 50 | 8 | 77 | 20 |
| **S30** | 83 | 47 | 56 | 5 | 114 | 28 | 8 | 47 | 34 | 12 | 126 | 50 | 12 | 41 | 52 | 16 | 51 | 16 |

**Table 3. Summaries of minimum, maximum, average, median , std dev and std error for FC and TC.**

| | 2014 | | | | | | 2015 | | | | | | 2016 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S.NO | WINTER | | SUMMER | | MONSOON | | WINTER | | SUMMER | | MONSOON | | WINTER | | SUMMER | | MONSOON | |
| **Min** | 12 | 0 | 0 | 0 | 28 | 4 | 0 | 3 | 21 | 0 | 43 | 23 | 0 | 11 | 31 | 0 | 15 | 13 |
| **Max** | 279 | 53 | 126 | 36 | 283 | 36 | 127 | 55 | 272 | 42 | 303 | 66 | 171 | 71 | 175 | 46 | 224 | 78 |
| **Average** | 130 | 23.5 | 48 | 10.8 | 152 | 20.2 | 46.9 | 30.3 | 103 | 12.8 | 167 | 46.7 | 85.1 | 45.8 | 89.6 | 21.4 | 101 | 26.5 |
| **Median** | 125 | 20 | 37.2 | 6.5 | 142 | 19 | 36.5 | 31 | 93 | 8.5 | 162 | 53 | 89.5 | 47.5 | 91 | 21.5 | 92 | 26.5 |
| **std dev** | 70.7 | 16.1 | 39.1 | 10 | 72.3 | 8.72 | 42.9 | 15.2 | 60.7 | 12.6 | 73 | 12.8 | 42 | 15.8 | 39.1 | 14.6 | 52.2 | 7 |
| **std error** | 12.9 | 2.94 | 7.14 | 1.83 | 13.2 | 1.59 | 7.84 | 2.78 | 11.1 | 2.31 | 13.3 | 2.33 | 7.67 | 2.89 | 7.14 | 2.67 | 9.52 | 1.28 |

The Total Coliform bacterial count found in three seasons - monsoon, winter and summer - are found to be higher than the permissible limit of WHO (10/100 ml of MPN coliforms)[8]. The TC values in the three seasons are found as 0-279, 0-272 and 15-303 in winter, summer and monsoon, respectively. The high value was found to be S2 at 2015 in monsoon seasons . the most of the station is above the permissible limit of WHO It is unsuitable for drinking and agricultural purpose.

The Faecal Coliform counts in water samples are observed to be 0-71, 0-46 and 4-78 in winter, summer and monsoon, seasons, respectively. The values are higher than that of WHO permissible limit (0/100 ml MPN coliforms). The high value was found to be S23 at 2016 in monsoon season . the most of the station is above the permissible limit of WHO It is unsuitable for drinking and agricultural purpose.

The maximum bacterial contamination was observed in the samples collected in monsoon season. Sewage disposal practices like soak pit system and septic tank near the bore wells are also contributing to increase in the bacterial contamination.[9]

According to Potgieter *et al.,* the contamination depends on seasonal variations and resistance of particular bacteria to environmental conditions.[10] The low TC and FC count in the dry season is attributed to the water being low in the dry season, due to lack of recharge, this affects the oxygen content which in turn decreases the multiplication of bacteria.[11]. Low temperatures in the dry season could also reduce the amount of Oxygen available and hinder the bacterial process .[12]

High coliform counts in water samples are an indication of poor sanitary conditions in the community. According to Adekunle *et al*., and Hamil and Bell, inadequate and unhygienic handling of solid wastes in the rural and urban areas leads to high concentrations of microbial organisms.[13-14] During the study, it was observed that some of the boreholes are electrical such that the water is pumped into pipes for distribution. Rusty pipes affect the quality of water by allowing seepage of microbial contaminants into the borehole. [15]

**Table 4. Classification of water on microbial quality for winter, summer and monsoon.**

| | Winter | | Summer | | Monsoon | |
|---|---|---|---|---|---|---|
| | **T.coliform** | **F.coliform** | **T.coliform** | **F.coliform** | **T.coliform** | **F.coliform** |
| Good | 11% | 2.5% | 18% | 17% | 0% | 0% |
| Marginal | 48% | 9.5% | 58.5% | 30% | 33.5% | 4.5% |
| Poor | 41% | 88% | 23.5% | 53% | 66.5% | 95.5% |

The study area was classified into three zones according to TC values, that is, good (<10 cfu.100 ml) , marginal (10-100 cfu.100 ml) , and poor (> 100 cfu.100 ml)categories . According to FC distribution 11% ,48%, and 41% of the samples fall in a good, marginal and poor zones in the winter seasons . 18% , 58.5%, and 23.5% of the samples fall in a good, marginal and poor zones in the summer seasons 0% , 33.5%, and 66.5% of the samples fall in a good, marginal and poor zones in the monsoon seasons.

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The study area was classified into three zones according to FC values, that is, good (0 cfu.100 ml), marginal (1-10 cfu.100 ml), and poor (> 10 cfu.100 ml)categories . According to FC distribution , 2.5% , 9.5%, and 88% of the samples fall in a good, marginal and poor zones in the winter seasons . 17% , 30%, and 53% of the samples fall in a good, marginal and poor zones in the summer seasons 0% , 4.5%, and 95.5% of the samples fall in a good, marginal and poor zones in the monsoon seasons

**Figure 2. Classification Facal coliform on ground of water**

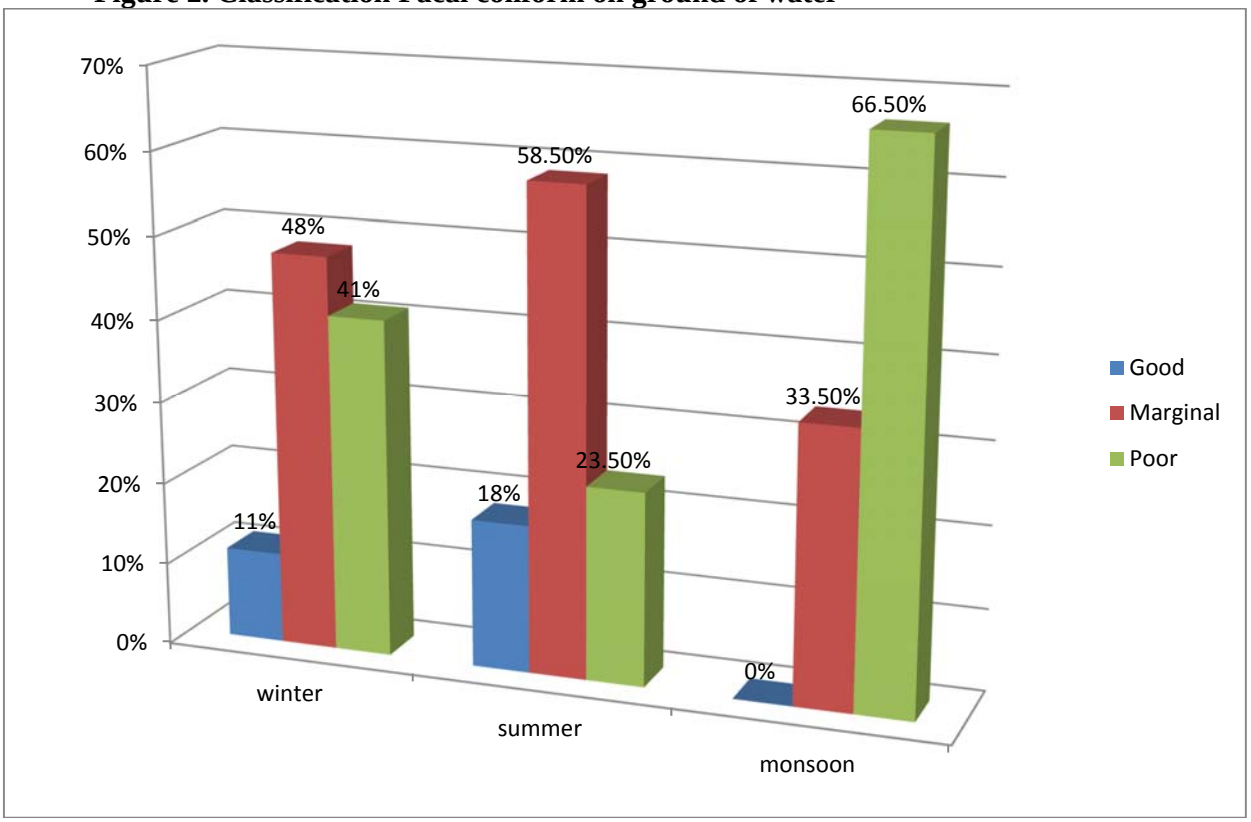
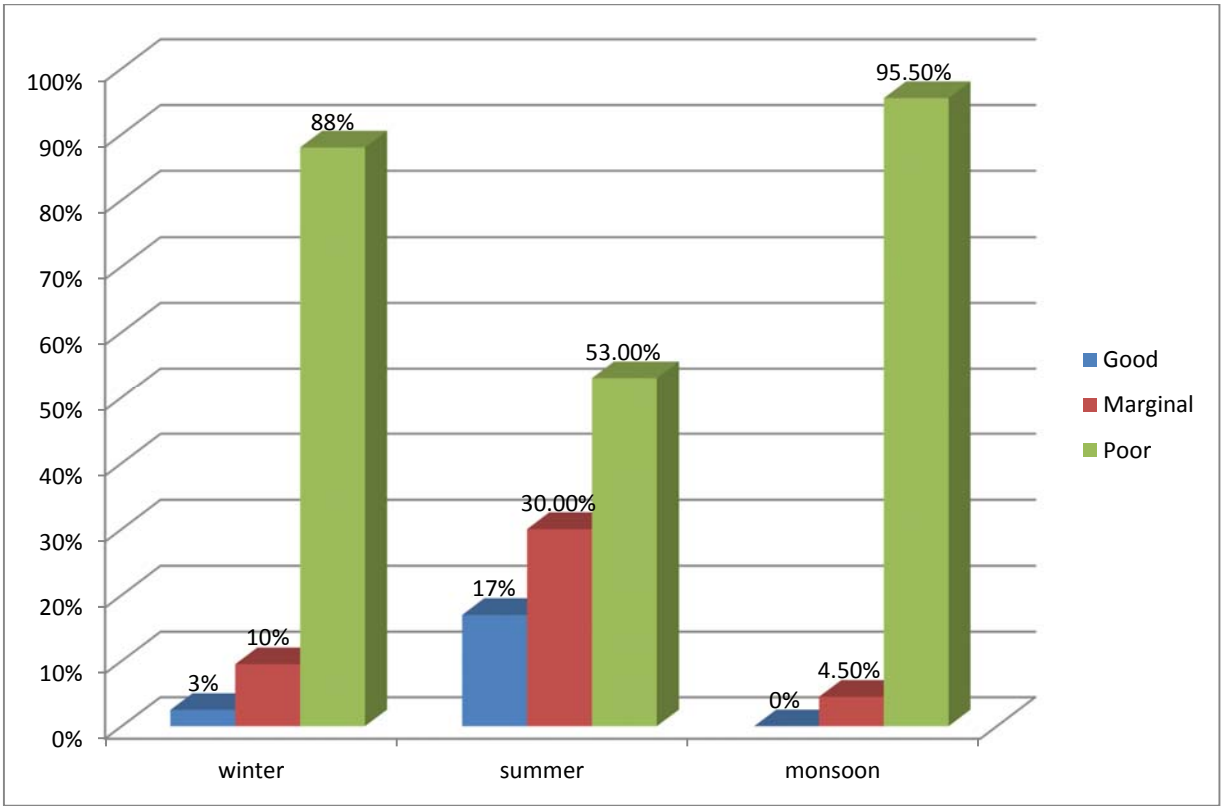



**Figure 3. Classification Total coliform on ground of water**



## 5. CONCLUSION

The present study revealed that most of the ground water samples in study area have failed to meet the bacteriological quality parameters throughout the year of 2014 to 2016. The maximum bacterial contamination was observed in the samples collected in monsoon seasons. Sewage disposal practices like soak pit system and septic tank near the bore wells are also contributing to increase in the bacterial contamination. Thus the study reveals that raw ground water is not safe for human consumption. In order to meet the portability of ground water it is recommended that continuous, effective treatment combined with constant monitoring is essential to ensure that it meets the standards of drinking water.

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