IMPACT OF WATER POLLUTION ON THE HEALTH OF DALIT HOUSEHOLDS IN VELLORE DISTRICT, TAMIL NADU

Dr.T.SARAVANAKUMAR*

Assistant Professor, Department of Economics, Periyar Govt. Arts College, Cuddalore

ABSTRACT

Ground water is such an important Source of drinking water. Its contamination causes a serious threat to human health. It is linked to illnesses ranging from bacterial infection to cancer. Ground Water is becoming one of the most potentially dangerous contaminating sources; Entry of water pollutants with various substances into a hydro-geological system is through anthromorphic activities. It has been respond that in developing countries polluted water accounts for 80 per cent of diseases. Industrial effluents particularly in Palar river bed often results in Pollution ground water which is polluted by tanneries. It is interesting to note that more than 30 percent of the dalit were not affected by health care, perhaps it may be due to the selected respondents have more knowledge to the problems caused by impure drinking water through mass media and the camps conducted by the voluntary organizations especially Hindu trust mission and Christian, besides the camps conducted by the medical colleges in the study area. However, more than 70 percent of the respondents have been affected by the water borne diseases, irrespective of the blocks selected. The Maximum health problems could be seen in skin allergy, followed by respiratory infections and the other diseases like gastritis, allergy, joint pain and ulcers and so on. It is said that the tanneries do not biologically treat the effluents. The situation existed at a time when various tanneries at Ambur, Walajah, Arcot, Vaniyambadi and Ranipet, Claim that the effluents are systematically treated before discharge into the Palar river, main water sources for the northern parts of Tamil Nadu.

Key-Words: Health Status, Health Seeking Behaviour, Chronic disease, Acute diseases

Introduction

The health status of the villages in the study area was assessed through the medical camps, Doctors who participated in the medical camps were able to identify the symptoms of water borne disease and health problems such as skin allergy, respiratory infection, general allergy, gastritis and ulcer were common among the villages who attended the medical camp. It was medically accepted that the polluted water has significant influence on these diseases. It was assessed that one – fourth of the villagers had any one of the listed diseases, most of the diagnosed patients accepted that they were using either the river water (or) well water or both for washing purpose, After realizing the ill effects of the polluted water they totally avoided using at present. The present study on the assessment of economic losses in Palar river Basin was undertaken with a view in knowing the extent of average economic loss per annum. It is very clear and evident from the study that the sample villages in Palar river basin have been directly effused by the partly treated or untreated industrial effluents. The magnitude of damage caused water pollution and human health.

Statement of the Problem

The present study on the "Economic impact of water pollution on Dalit households; A case study of Palar river basin, Tamil Nadu, is undertaken to assess the economic losses, interms of damages in agricultural sector, livestock, human health, drinking water, fish production and consequent migration due to water pollution. The assumption of pollutants due to continuous discharge of chemical effluents by the processing tannery units in Vellore has exceeded the assimilative capacity of land and water, and has severely affected in Vellore district, particularly the areas downstream of the Palar River. The level of pollution is high in the ground water, in the surface water sources (River, Tanks, and reservoir) and to some extent in soil.

Industrial pollution has been the most important factors causing water pollution. Industries release the water effluents containing chemicals and biological matter that impose high demand on the oxygen in the water. After semi-treatment or without treatment, the effluents are released into water bodies that are polluted water contains low levels of dissolved oxygen (DO), as the result of heavy Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), Release of untreated effluents to river, levels to severe damages to the characteristics of surface water, soil quantity, ground water, quality and aquatic life. The drinking water quality has also degraded, since most of the wells are polluted in the study area.

Polluted water is a complex water resource with both advantageous and disadvantageous. Generally the use of polluted water for irrigation has an advantages of crop production so benefits to formers and the whole community, but also harmful for the people and whole ecosystem of the concerned area. The main reason is the non-availability of enough funding to treat polluted water before using for irrigation purposes. it degrades the environment as well as a cause of water borne diseases in the said area, all polluted water contains plant nutrients and also organic matter, other than high concentration of soluble salts and heavy metals. Farmers use polluted water, to save their expenses, but harmful can last for severally years due to extensive irrigation of polluted waters, so it can reach down to the soil. But also has a negative effect on ground water quality in India more than eighty percent of the population use ground water for drinking purpose. The effects of water pollution are numerous. Some water pollution effects are recognized immediately, whereas the other don't show up for months or years when toxins in the water, the toxin travel form the water the animals drink to humans when the animal meat is eaten, so the pollution enter the food chain. Infections disease such as typhoid and cholera can be contracted from drinking contaminated water. This is called "microbial water pollution". The human heart and kidneys can be adversely affected, if polluted water is consumed regularly. Other health problems associated with polluted water are poor blood circulation, skin lesions, vomiting, and damage to the nervous system. In fact, the effects of water pollution are said to be the leading cause of death for humans across the globe.

Objectives

The present study is aimed at studying the economic cost and environment degradation in and around the area from the Palar river basin in Vellore district. In order to make the study focused and to have clear direction. The objectives as follows:

1.   To evaluate the economic impact of water pollution on drinking water, human health and migration of the Dalit households in the study area between the pre and post pollution periods.

Hypotheses

Keeping in mind the objectives of the study areas and also the characteristics of the data, the following hypothesis have been formulated in the present study.

1. There is no significant difference in the water quality on human health status among the study areas between pre and post pollution period.

Sampling Design

The sampling design of the study is based on four stages in order to elicit the acute information in the field of enquiry. The for system are:

Stage 1: Selection of one district in Tamil Nadu

Stage 2: Selection of four blocks in the selected District Vellore, namely Walajah, Arcot, Kaveripakkam, and K.V.Kuppam.

Stage 3: Selection of two villages in each and the selected blocks are Gudimallur, Ananthabai, Arubattu,Kalampattu, Puthupadi and K.Velore, Athipattan and Keeleeranam.

Stage 4: Selection of Dalit households by covering villages in the selected blocks.

1) Therefore, the Vellore district is selected as the first stage by using purposive sampling procedure.

2) In the second stage far blocsk are selected in Vellure district. The extent of are affected by turneries effluent in Palar river basin is taken as the yard stick for selection of four blocks in Vellore district.

3) In the third stage tow villages are selected in each of the selected blocks, in which the highest area affected by the Tanneries effluent in Palar river basin, being covered.

4) In the fourth stage, about 25 households in each of the villages are covered. Thus, about 200 sample households (8 villages x 25 Dalit households) are covered by covering four blocsk's of Vellroe district.

Concept

Water Pollution

Water runoff, a nonpoint source of pollution, carries fertilizing chemical such as phosphates and literates from agricultural fields and yards into lackes, streams and rivers. These combine with the Phosphates and nitrates from sewage to speed the growths of algae, a type of plant like organism. The water body may then become choked with decaying algae, which severely depletes the oxygen supply.

Impact of Health

With a view to identifying the impact of industrial effluent on human health, first hand information has been obtained. There health camps are conducted at 3 centers on different dates. Around 200 Villagers attended all the three medical camps, around 19 Village have been covered in the camp. The villagers are given due publicity about the camp. 11 doctors from the Indian Medical Association, Vellore and adjoining places conducted the camp. It is evident from the medical camp that they are contacted to assess the health status of the people has resulted in given the first hand information. The secondary information are covered interms of number hospitals, hospital distance, no of staff, doctors in the hospital, frequency water prone diseases in the villages, Primary information covers interms of reasons for health problems, no days of ill, medical expenditure, number of man days lost, wage lost etc.

Framework of Analysis

The ANOVA model-three way classification is adopted by taking three factors of house, type of diseases, total loss of households due to health problems.

Review of Literature

Rashmi Verma and Pratima Dwivedi (2013) in their analysis heavy metals are dangerous because they tend to bioaccumulation. Bioaccumulation means an increase in the concentration of a chemical in a biological organism over time, compared to the chemical concentration in the environment. Compounds accumulate in living things any time they are taken up and stored faster than they are broken down (metabolized) or excreted. Heavy metals can enter a water supply by industrial and consumer waste, or even from acidic rain breaking down soils and releasing heavy metals into streams, lakes, rivers, and ground water. Heavy metal toxicity can result in damaged or reduced mental and central nervous function, lower energy levels, and damage to bood composition, lungs, kidneys, liver, and other vital organs. Long-term exposure may result in slowly progressing physical, muscular, and neurological degenerative processes that mimic Alzheimer's disease, Parkinson's disease, muscular dystrophy, and multiple sclerosis. Allergies are not uncommon and repeated long-term contact with some metals or their compounds may even cause cancer (International Occupational Safety and Health Centre 1999).

Impact of Water Pollution on Human Health of the Dalit Households

Ground water is such an important source of drinking. Its contamination cause a serious threat to human health. It is linked to illnesses ranging from bacterial infection to cancer. Ground water is becoming one of the most potentially dangerous contaminating source. Entry of water pollutants with various substances into a hydro-geological system is through anthromorphic activities. It has been reported that in developing countries polluted water accounts for 80 per cent of diseases.

Industrial effluents particularly in Palar river bed often results in pollution ground water which is polluted by Tanneries. It is said that the tanneries do not biologically treat the effluents. The situation existed at a time when various tanneries at Ambur, Walajah, Arcot, Vaniyambadi, Ranipet, claim that the effluents are systematically treated before discharge into the Palar, main water source for the northern parts of Tamil Nadu. But it is revealed from the fact that tanneries openly stock the effluent inside their campus and allow it to dry on its own during the night hours of the day. The stench from the effluent is unbearable. The residents say tha they suffer from various healths related problems. Most of them complain of wheezing and show signs of asthma. The tanneries not only cause air pollution, but also affect the ground water table in the area. The effluent mixes with the ground water. The water available in the area has a mix of pollutants and it is totally unfit for agricultural production and allied activities. Hence, the residents are forced to purchase water from outside and a sizeable portion of their income is spent on purchasing drinking water. The inference is that only rich can lead disease-free life by drinking safe mineral water and the poor can drink only the polluted water.

The primary data was collected from 200 Dalit households in the selected villages of blocks viz Walajah, Arcot, K.V.Kuppam and Kaveripakkam, by adopting schedule and questionnaire methods during the year 2015. The households were selected by using satisfied random sampling method. In this process, the Dalit household comprises of land-less agricultural labourers, marginal small farmer and medium farmers as their primary occupation. Out of 200 Dalit households above 75 of the households have sub-occupation of government services business and industry workers. The faced to faced by problems of the Dalit households includes sickness and medical expense, man-days loss, wage lost and total loss of the Dalit households are also estimated.

Types of Health Problems

The results are presented in Table 1 out of 200 people selected for the study 5 percent of them did not witness health problems during the survey period. Of the remaining 92 percent, 41 percent of them are suffering from skin allergy, followed by respiratory infection 16 percent. allergy 10.5 percent, ulcer 9.5 percent, gastritis 8 percent, joint pain 6.5 percent. Therefore, the major causes of Palar water pollution could be attributed to skin allergy and respiratory infections.

Days of Sickness

The results pertaining to days of sickness by the Dalit households due to water pollution can be seen in Table 2. About 46 percent of respondents have not been subject to sickness. In other words, even a single day they have not taken bed rest in the study period. About 10 percent respondents have availed bed rest more than 9 days. About 30 percent of the Dalit households have suffered between 1 and 5 days.

Table-1 HEALTH PROBLEMS DUE TO WATER POLLUTION

Diseases	Frequency	Percent
Skin Allergy	82	41.00
Respiratory infection	32	16.00
Gastritis	16	8.00
Allergy	21	10.50
Joint pain	13	6.50
Ulcer	19	9.50
N.A.	17	8.50
Total	200	100.0

Source: Computed

Table-2 WATER POLLUTION DAY OF SICKNESS- HOUSEHOLD INFORMATIONS

Days in a year	Frequency	Percent
0.00	93	46.50
1.00	14	7.00
2.00	15	7.50
3.00	10	5.00
4.00	13	6.50
5.00	11	5.50
6.00	12	6.00
7.00	8	4.00
8.00	5	2.50
9.00	9	4.50
10.00	10	5.00
Total	**200**	**100.0**

Medical Expenses

The table -3 exhibits the household medical expenses incurred per annum. The medical expenses are shown as direct cost and indirect cost. The direct components include transport varanda fees, medicines, hospitalization, food, cost of special diet, doctor fees, lab test and so on. The indirect costs include loss of mandays and the loss of wages. It is seen from the result that, about 51 per cent of the Dalit households have not incurred medical expenses. These households can adjust to environment and have strong immunity to remain disease free. The remaining 49 percent of the Dalit respondents incurred the medical expenses. Out of this category, about 10 percent of the respondents have incurred medical expenses between Rs. 900 and 5000. It shows that the Dalit households have incurred the 1st expenses towards medical expenses. Perhaps, it may be due to these people have availed pre medical services either from the public hospital or the primary health centres or the medical camps conducted by the trust/medical colleges and so on. Secondly, they did not have sufficient economic to avail medical services from the private hospitals. thirdly, in Vellore district the majority of the people, especially down trodden group are mostly Dalit Christians, Therefore they take advantages of pre medical services offered by the Christian mission hospitals.

Table-3

HOUSEHOLD MEDICAL EXPENSES

Days in a year	Frequency	Percent
0.00	102	51.00
1-100	7	3.50
101-200	5	2.50
201-300	9	4.50
301-400	8	4.00
401-500	11	5.50
501-600	10	5.00
601-700	6	3.00
701-800	12	6.00
801-900	12	6.00
901-1000	6	3.00
1001-1500	8	4.00
1501-5000	4	2.00
Total	**200**	**100.00**

Source: Computed

Man Days Lost

The table-4 exhibits the man days lost by the Dalit households due to sickness from the water pollution. It is an astonishing fact that about 66 percent of the dalits have no sickness due to their hard labour in agriculture or non-farm works like construction of buildings. road works. As a result maximum dalits are not affected by diseases. About 17 percent of dalist have sort 10-mandays and the balance 18 per cent of Dalit have lost between 11 and 25 days in hospitalization. The results are shown in table 4.

Table-4

MAN DAY'S LOSS

Man day's loss in a year	Frequency	Percent
0.00	132	66.00
1.00-5.00	15	7.50
6.00-10.00	18	9.00
11.00-15.00	11	5.50
15.00-20.00	14	7.00
20.00-25.00	10	5.00
Total	**200**	**100.0**

Table-5

WAGE LOSS

Wage Loss	Frequency	Percent
0.00	94	47.00
1-50	12	6.00
75-200	5	2.50
300-500	16	8.00
600-800	7	3.50
900-1000	10	5.00
1200-1500	21	10.50
1600-2500	15	7.50
2500-10000	20	10.00
Total	**200**	**100.00**

Source: Computed

Wage Loss

It can be seen from the table 5 that out of 200 Dalit respondents, due to sickness 53 percent have lost their wages in a year. More than 27 percent of the households have lost wages between Rs. 1000 to Rs. 5000 rupees per annum. Therefore, half of the Dalit's have not focused away problems of sickness, man-days lost and also the loss of earnings.

Table 6

Total Loss After Pollution (Household Information)

Total Loss in a year	Frequency	Percent
0.00	118	59.00
1-100	10	5.00
101-300	6	3.00
301-500	8	4.00
501-800	9	4.50
801-1000	5	2.50
1001-1200	11	5.50
1201-1500	13	6.50
1501-2000	7	3.50
2001-3500	8	4.00
3501-9000	3	1.50
9001-15000	2	1.00
Total	**200**	**100.00**

Source: Computed

Total Loss of the Dalits

From the table results in 4.39 one could infer the total loss caused by pollution leading to sickness of the dalits resulting in wage earnings and medical expenditure. About 6 percent of the respondents have incurred the total loss between Rs. 2000 to 1500 per annum. About 41 per cent of the dalits have incurred a big loss due to water pollution. i.e., between Rs. 1501 and Rs.15,000/- per annum.

As indicated in the earlier pages, the Hindu trust, Christian medical missions and medical colleges have conducted medical camps in the study areas to create awareness about the disease caused by water pollution, pre distribution of medicine to the affected groups. During the year (2015), there were three medical camps conducted by above institutions in the study area.

It is interesting to note that more than 30 percent of the dalits were not affected by health care. Perhaps it may be due to the selected respondents have more knowledge to the problems caused by impure drinking water through mass media and the camps conducted by the voluntary organizations especially Hindu trust mission and Christian, besides the camps conducted by the medical colleges in the study area. However, more than 70 percent of the respondents have been affected by the water borne diseases, irrespective of the blocks selected. The maximum health problems could be seen in skin allergy, followed by respiratory infection and the other diseases like gastritis, allergy, joint pain and ulcers and so on.

It is seen from the results on medical expenses more than 33 percent of respondents have incurred more than Rs. 1000 and above in Walajah and Arcot blocks, about 27 percent from K.V.Kuppam dalits have incurred the Medical expenses between Rs.500 and Rs.1000. It is surprising to note that more than 30 percent respondents have not incurred medical expenses,especially from the blocks of K.V.Kuppam and Kaveripakkam. The results imply that the sickness and medical expenses are relatively higher in Walajah and Arcot blocks, mainly due to the concentration of Tannery industries in and around these blocks.

The total loss is indicated by the loss of wage income during sickness and the medical expenses incurred by the Dalit respondents. The results show that more than 30 percent of the households have incurred the total loss of more than Rs.2000 and above in Walajah and Arcot blocks. On the other hand, there is negligible wage loss and medical expenses on Dalit households in K.V.Kuppam.

Objectives

The impact of water pollution on health problems, loss of households among the blocks selected in Vellore district:

Frame work of analysis

The main objectives of the present section is to analyse the type of diseases caused by water pollution and its impact on total loss of households comprising wage loss and medical expenses among the dalits in Vellore district. In this context, the ANOVA model three way classifications is a justifiable technique for verifying the hypotheses of the present section. Three factors viz. type of diseases, total loss of households and the blocks selected are taken for the analysis. The general model is illustrated below.

$$X_{ijk} = \mu + \alpha_I + \beta_j + V_k + \Sigma_{ijk}$$

Where, X_{ij} is the kth component of total loss of the household due to i^{th} disease in the jth blocks.

μ is the general effects of the health status

α is the additional effects due to i^{th} disease

β_j is the additional effects due to j^{th} blocks

μ_k is the general effects of the health status

Σ_{ijk} are the random residual effects

Σ_{ijk} are identically, independent and normally distributed withmean 'O' variance 'σ^2',

Results and Discussion

The health status of the Dalit households is found to be statistically significant 'F' value of 29.09, Table NO. 5.2 which is found to be statistically significant at 5 per cent level. It means that there is a significant variation on health status of the Dalit households among the blocks selected. It is inferred that the health is severely affected in Walajah and Arcot blocks than K.V.Kuppam and Kaveripakkam blocks due to because the diseases caused by chemical effluents discharged by the tannaries, which are concerntrated heavily in and around the town centers of Walajah and Arcot and hence the impact on health is severe. Hence, the null-hypothesis framed in this regard, is rejected. In otherwords, the alternative hypotheses viz the health problems are relatively higher in Walajah and Arcot blocks than K.V,Kuppam and Kaveripakkam blocks.

The computed 'F' value on health problem is 36.00, which is found to be statistically significant at 5 per cent level. In otherwards, the skin allergy is found extensively leading to skin problems due to water pollution, followed by respiratory infection. The other problems viz gastritis, allergy, joint pain and ulcer are also seen. Therefore, the second null hypothesis is rejected. In otherwords, the alternative hypothesis viz. the type of diseases are higher in skin allergy, followed by respiratory infection.

The total loss of the household differs significantly among the different groups i.e., total loss less than 500 per annum, Rs. 500 to 2000 and above Rs. 2000, with computed (F) value is 11.90, which is founded to be statistically significant at 5 per cent level. The results indicate

that the total loss incurred by the Dalit respondents remain higher between Rs.2000 and Rs. 15000. Therefore the third null hypothesis is rejected. The alternative hypothesis viz, the total loss of the household is relatively higher irrespective of the blocks selected.

Table 7

ANOVA Model-Three Way Classification on Health Status

Sources of variation	Degrees of freedom	Sum of squares	Mean sum of squares	F-ratio	F-Value at 5% level
Variation due to blocks	r-1 4-1=4	1835	611	29.09**	F 3,43 2.83
Variation due to health problems	c-1 3-1=3	1513	756	36.00**	F 2,43 3,23
Variation due to total loss of households	s-1 4-1=3	750	250	11.90**	F 3,43 2.83
Error	(rs-1)(c-1) s-1=35	720	21		
Total	Rsl-1 44-1=43	4818			

Source: Computed

*Significance of F-Value at 5% level

Conclusion

The health status of the Dalit households is found to be statistically significant with 'F' value of 29.09, Table 6.7 which is found to be statistically significant at 5% level. It means that there is a significant variation on health status of the Dalit households among the blocks selected. It is inferred that the health status is severaly affected in Walajah and Arcot blocks than K.V.Kuppam and Kaveripakkam blocks, because of the diseases caused by chemical effluents by the Tannaries, which are concentrated heavily in and around the town centers of Walajah and Arcot and hence the impact on health is severe. Hence, the null-hypohtesis framed in this regard, is rejected. In other words the alternative hypotheses that the helath problems are relatively higher in Walajah and Arcot blocks than K.V.Kuppam and Kaveripakkam blocks.

The computed 'F' value on health problems variation is 36.00, which is found to be statistically significant at 5% level in other words, the skin allergy is found extensively due to water pollution followed by respiratory infection. The other problems gastritis, allergy, joint

pain and ulcer. Therefore the second null hypothesis is rejected. In other words, the alternative hypothesis that the type of diseases differed according to severe due to water pollution. The prominent health problems is skin allergy followed by respiratory infection.

The results indicate that the total loss incurred by the Dalit respondents remains higher between Rs.2000 and Rs.15000. Therefore the third null hypothesis is rejected. The alternative hypothesis namely the total loss of the household is relatively higher, irrespective of the blocks selected.

Under these circumstances, the impact of industrial effluent on women health has been assessed in the study area. For this purpose, three helath camps were conducted covering 25 villages, Apart from this, a household survey has also been conducted among 200 Dalit households. In the medical camp and household survey, the following information were collected to assess the health status of the villages.

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