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Domestic Environmental Issues Due to Contamination of Drinking Water in Developing Areas

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Abstract: ***This study aims to explore household environmental problems in rural areas of Kolar Taluk, Karnataka. The connection between various household environmental health issues and income of the people of Kolar taluk Karnataka have been studies. The data required for the study were gathered by questionnaire from distribution method, 277 individual families were selected from 10 villages in the taluk at different subsections. After the analysis of the data samples of water were collected from bore well and open containers those used by village dwellers and analyzed for pollution parameters, Multiple regression and Chi-square analysis were done and found to be that income and environment variables are significant at 1% level in Chi-square model. Multiple regression models were predicted for low, middle and high income households with respect to contributing variables of diseases. It is found that prevailing non-latrines and water storage methods were effective parameters which have significant effect on the model. The multiple regression model predicts that 78.2% deviation in dysentery with the parameters selected, but for jaundice, it was 90.5% using water from open storage containers. It was observed that bacteriological quality of drinking water declines significantly and deterioration occurs between the point of supply to consumption.***

Keywords: ***Fresh water, Household, quality of water and Contamination.***

I. INTRODUCTION

This is an One of the important household environmental concerns is fresh water, that is used for the domestic purposes. The contamination of fresh water connects the contamination of sources of water such as reservoirs, streams, lakes and rivers. It is very difficult to address the reasons behind the contamination of water sources such as marine dumping, metropolitan city runoff, oil leaks, and mixing of wastewater [1, 2].

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Therefore, it is necessary to ensure the drinking water quality standards set by the environmentalists in order to limit the levels of various contaminants such as microbes, organic composites, inorganic composites, decontaminators and radionuclides [3-5]. It is possible to bring down the toxic levels of the above water contaminants through various treatment processes. The study concludes that water pollution is due to lack of hygienic practices, the prevailing practices of storage, collection and disposal of solid waste and their management in the villages are unsatisfactory resulting in the accumulation of waste in hazardous manner [6].

Several studies are available in the literature which have reported the water quality and behavioral factors of diarrhea diseases, economical, behavioral technical and infrastructure are the influencing factors which are connected to various health issues such as Dysentery, Jaundice and Malaria etc. The technological and infrastructure perspectives highlight the definite requirement of plentiful and proper supply of uncontaminated water and adequate sanitation services to every families [7]. Latest technology and infrastructure variables (like Quality of water, piped water etc.) are the solutions for prevailing health issues also the awareness of hygiene can effectively reduce diarrhea [8] . The importance of adequate water quantity and quality in protecting human health has been recognized for many years [6].

It is also observed in the study that that the storage method adopted in the developing areas causes substantially water contamination leading to higher mean coli form levels in the old methods of stored household water than in water sources. [9]. It is found that observed samples from different water sources and household storage containers when analyzed, the results were almost similar, it is noted that fecal coli form concentrations were normally more in household water than in sources of water. During the recent widespread cholera study, water was sampled from municipal taps and from stored households taps and noted to be thousand-fold increase in mean fecal coli form counts. When the quality of the drinking water at home is not up to the mark, the health effects are likely to be far more severe than those arising from other means. It is also to be noted that similar conditions applies when kitchens are smoky, indoor air pollution, sanitary facilities are poor solid waste remains uncontrolled [6, 9].

Economic vibrancy and means of livelihood are the chief causes of household environmental problems at villages. It has been shown that normally lower income groups are aware and affected by the hazards of keeping household waste open at near homes but inefficient municipal solid waste management for its periodic collection and appropriate treatment methods is not in practice.

The waste remains uncollected for weeks and months due to poor economic conditions; they are unable to do anything about the garbage collected in their households [3]. Improper management of solid waste leads to breeding of mosquitoes and pests and rats, etc. Which causes a wide range of health issues like respiratory diseases malaria etc. in various villages [4].

This work aims to minimize the household environmental problems at villages with regard to drinking water contamination and also assess household water supply, sullage and drainage of water (sources, amount of water supply, and mode of water storage), disposal of solid and liquid household waste, drainage facilities and also water logging. And study the characteristics of drinking water quality in study area.

II. METHODOLOGY USED TO OBTAIN REQURED DATA

For studying the household environment problems, villages were randomly selected in Kolar taluk. In which 5 low income villages, 3 medium income villages and 2 modern villages selected for my study purpose at Kolar taluk which declared by Kolar taluk office, statistical office village panchayat office kolar taluk, based on income of the households. Details of sample villages with household along with the Constituency in Kolar Taluk has been presented in Table 1. Out of the 2770 households of villages. 277 (10%) were sampled for this study. Random sampling has been done by keeping the parameter income of different groups which will represent proportionate quality parameter of the samples taken [6, 9]. The schematic of the methodology adopted has been shown in Fig 1.

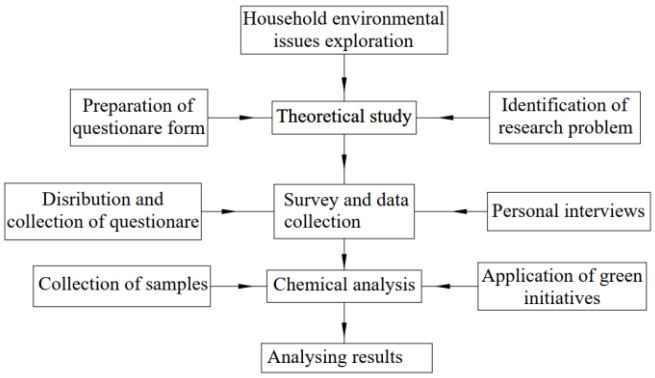

Fig. 1 Methodology used in the study

III. PRIMARY DATA COLLECTED THROUGH QUESTIONNAIRE METHOD

In this study both primary and secondary data were collected through observations and interviews by through questionnaire method The data required for the analysis were listed systematically in the questionnaire form, the eight main questions were particularly of household data such as, housing details, water supply, disposal of garbage and sullage, solid waste drainage system, latrine facility, indoor air pollution, household environment and health. It is known that conducting interviews every house hold for all the particulars is extremely difficult in order to get the data of a socio-economic survey. [6, 9]. In order to resolve the difficulty, the study areas were spatially divided into different zones (higher income, medium income, low income) on the basis of Income of the people for the study purpose.

IV. SAMPLING PROGRAMME OF DRINKING WATER

Because of bad sanitation in village areas, water quality may also degrade. Majority of households mainly use open containers for water storage. To achieve the objectives, water samples were collected from public tap (bore well water as a source of drinking water) and household open container maintained by village dwellers. For the purpose of present analysis, 6 sets water samples were collected from randomly selected villages. Standard procedures were followed during the collection of all water samples in this study, and then transported to the Environmental Engineering Laboratory of S.J.C. Institute of Technology, Chickballapur, and stored at 4oC in refrigerator until analyzed.

V. CHI SQUARE TEST

Chi-Square ($\chi 2$) is known for its non-parametric statistical testing for all the nominal (categorical) data that involved extensive data range of house hold problems or any other frequency. This test was selected to due to its simplicity in representing the good fit between actual sample data and the previously established distribution data by maintaining the basic relations between the two.

The chi square value is calculated as follows:

$$\chi^2 = \frac{(O-E)^2}{E}$$

$$\chi^2 = \sum \frac{(\text{Observed frequency - Expected Frequency})^2}{\text{Expected frequency}} \qquad \chi^2_{(n-1)df}$$

'df ' is the 'degree of freedom (n – 1)

χ^2 is 'Chi Square'

VI. RESULTS

A. Household water supply

The deficiency of acceptable water pressure in the water distribution system origins inopportuneness and also severe health hazards as it leads to water contamination. Until recently, most villages in Kolar taluk dwellers obtained their water from a combination of government

Table 1 Details of Sample Villages with Household Details Constituency Wise in Kolar Taluk

Sl. No.	Constituency	Name of the village	Total No. of House- holds	Sample House Holds
High income villages				
1	Vemagal	Narasapura	860	86
2	Vemagal	Vemagal	690	69
Medium income villages				
3	Kolar Taluk	Kumbaranahalli	90	9
4		Tamaka	200	20
5		Thalagundha	260	26
Low income villages				
6	Kolar Taluk	Bethani	110	11
7		Maderahalli	80	08
8		Dhodahasala	170	17
9		Chikahasala	100	10
10		Basavanatha	210	21
		Total	2770	277

Source: Kolar Taluk Office and village panchayat report

bore wells, water vendors, public government tankers, taps. The particular of prevailing water supply conditions in the site of the defendants revealed the factors water supply system (regular or irregular), water supply source (piped water connection, tube wells or public roadside hand pumps, roadside piped water), volume of water supplied (adequate or insufficient) and method in which the water stored (exposed/closed containers). The information presented in Table 2 were collected through field surveys. The source of water supply for low income group was Roadside Hand Pump (RHP) and that of Medium and high income group observed to be Roadside Piped Water (RPW).

Table 2 The source of water supply of the sampled households according to their income group

Income Group	Public
Low	130 (RHP)
Medium	95 (RPW)
High	52 (RPW)
Total	**277**

Source: Field survey

B. Water supply

Drinkable and consistent water supply are the key parameters of developed areas. It is observed that 58.84% of low and 68.42 % of medium-income groups do not get regular water supply as they are fully dependent on public water supply system, this may be due to periodic power interruptions. Table 3 shows the percentage of each group of sampled homes based on the amount of water supply. Water supply in villages is very unclear and unpredictable because of scarcity of power supply in the study area. This insufficient quantity of water also leads hygiene problems in the village.

Table 3 Distribution of the sampled households according to amount of water supply in houses.

Income Group	sufficient	insufficient	Total
Low	30 (23.07%)	100 (76.92%)	130
Medium	30 (31.57%)	65 (68.42%)	95
High	10 (19.23%)	42 (80.76%)	52
Total	70	207	277
x^2= 58.40 df = 2 P-Value = 0.000			

C. Mode of water storage

The storage of water play an important role in the contamination of drinking water. Table 4 and Fig. 2 shows the split up in each group of sampled houses as per the mode of water storage in individual houses. The percentages indicate that the water contamination can be expected at low and medium groups as the percentages (73.84 and 42.1) are the higher side. The lower-income households have overcome shortage of water by storing water in containers such as tubs, vessels, buckets of various sizes. Lower-income households use water from public places like roadside hand pumps or piped water connections for cooking, cleaning clothes and utensils, and bathing. All these factors directly affect the health issues such as diarrhea, cholera and typhoid etc.

Table 4 Percentages of storage of water at the sampled households according to the mode of storage

Income Group	Stored in open containers	Stored in closed containers	Total
Low	96 (73.84)	34 (26.15)	130
Medium	40 (42.10)	55 (57.89)	95
High	5 (9.61)	47 (90.38)	52
Total	141	136	277
x^2 = 72.261 df = 2 P-Value = 0.000			

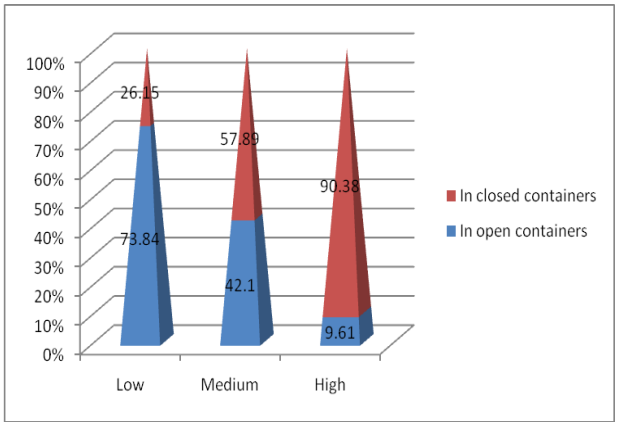

Fig. 2 Percentages of storage of water at the sampled households according to the mode of storage

D. Type of drainage

Table 5 and Fig 3 shows the prevailing conditions of the drainage system that ate existing at all the sampled homes. The open drains were also clogged and overflowing this was leading to waste water collection was on roads and also in open plots. The Chi-square value indicates a significant association between income and type of drainage around the house in villages.

Table 5 Percentage different drainage system based on the income groups

Income Group	Open	Partially closed	doesn't exists	Total
Low	30	0	100	130
Medium	30	10	55	95
High	10	42	0	52
Total	70	52	155	277
x^2= 180.852	df = 4			P-Value = 0.000

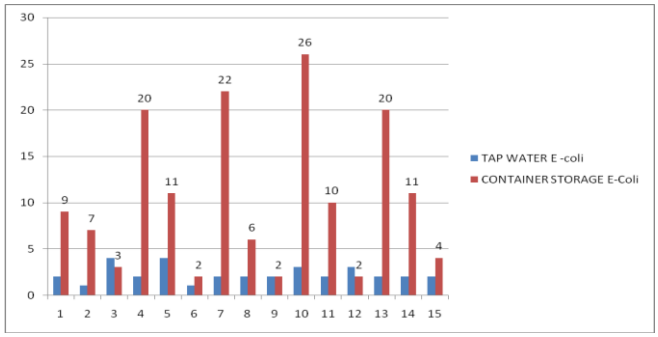

Fig 3 E-coli variations from tap water, container storage in the sample households from randomly selected villages.

Drinking water may be contaminated at the source itself or during its storage [10, 11]. It has been observed that different parts of the villagers are collecting water from unsafe surface sources, where the water ia already contaminated. The possibility of contamination of fecal and total coli form counts in the stored water containers are high during collection, transportation, storage and drawing of water, which must be stored and drawn in a safe manner; otherwise, water can be re-contaminated [12, 13]. The later often happens when there is a communal drinking cup or dipper on top of the covered storage vessel. The user dips this dipper into the water and contaminates it with soiled hands. In this way, bacteriological quality of drinking water normally reduces after collection and water-quality deterioration occurs between the point of supply and consumption. Multiple regression models representing the influence of variables to variable diseases has been presented in Table 6.

Table 6 Multiple regression models data and the contribution of different diseases (For medium income group).

Disease	Factor	t	R^2
Dysentery (constant)	0.9758**(0.1447)	6.74	
No latrines	-0.01394298	-0.85	
Unsatisfactory water quantity (amount of water supply)	0.5667**(0.1357)	4.17	0.782
Open storage of water	0.6742**(0.1589)	6.2	
Jaundice	1.0500**(0.1126)	9.33	
Using water from sources			
Open storage of water	1.0277**(0.2100)	7.58	
	0.47500**(0.06806)	6.98	0.905
Malaria	2.0533**(0.1223)	16.8	
Open drainage	0.3589**(0.0378)	5.8	
Water-logging area	-0.009285243	-0.14	0.97
Household pests	-0.253737036	-2.73	
Presence of mosquitoes	0.6758**(0.3421)	6.8	
Respiratory diseases	0.05710*(0.05703)	1	
ventilation issue in house			
Method of cooking meal	3.9297**(0.3246)	12.1	
Cooking fuel used			
smoking inside the house	0.4000**(0.1369)	2.92	0.82
	0.4608**(0.1533)	3.01	
	0.1986**(0.1104)	1.8	
	0.6000*(0.1054)	-5.69	

(Figures in parenthesis indicate the S.E.) * 5% level of significance, ** 1% level of significance

VII. CONCLUSIONS

Based on extensive field work and the results of the statistical models the following important conclusions can be drawn. Lack of work in drought–prone lands, family influence, low wages, unemployment, landlessness, dependence on agriculture is factors of water contamination.

The study establishes that the most severe household environmental and health issues effected more are lower-income households.

House hold storage of water prior to consumption is common place. The quality of stored water may potential play other than water supply and water quality. Hygiene interventions are expected to improve stored water quality. Possible source of house hold contamination includes unclean water containers, unhygienic domestic water handling practices, natural contamination from the ambient domestic environment as a result of uncovered containers.

Using Chi-square analysis, the study establishes that the income group and household environmental situations are highly substantial at 1% level. This proves there is close relationship between income and various environmental variables and quality of life.

Multiple regression models were predicted for low, middle and high income households with respect to contributing variables of diseases. It is found that no latrines, fecal matter and storage of water in open containers were effective parameters which have significant effect on the model. The coefficient of determination, R^2, shows that there is 42.4% variation in dysentery as explained by independent variables.

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