
Socio-Economic Influences on Water Consumption and Hygiene Practices in Virudhunagar District: A Comprehensive Analysis

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Abstract

This study examines the socio-economic factors influencing water consumption and hygiene practices in the Virudhunagar district of Tamil Nadu, India, utilizing data from 360 respondents across six blocks categorized by Human Development Index (HDI). The sample predominantly consists of females (68.06%) and individuals aged 20 to 40 years (64.17%). The analysis reveals that personal hygiene, house cleaning, and animal water consumption are significant categories of water use, with higher water usage correlating with better sanitation practices. Notably, (53.61%) of respondents earn between ₹10,000 and ₹20,000 per month, indicating a moderate income level that affects access to hygiene resources. The study finds that educational qualifications and occupation significantly influence hygiene levels, while marital status and family income also play a role. However, gender, age, and occupation do not show significant relationships with water usage patterns. The findings underscore the urgent need for tailored interventions to address the unique challenges faced by different households, particularly in accessing clean water and sanitation. By recognizing the disparities in water consumption and hygiene practices, policymakers can develop targeted strategies that promote efficient water use and enhance public health outcomes. Ultimately, the research highlights the importance of improving water management and hygiene standards as essential components for fostering sustainable development and ensuring the well-being of communities in Tamil Nadu and beyond.

Introduction

Water is an essential resource for sustaining life, and its availability and management are critical to public health, economic development, and environmental sustainability. Globally, the increasing demand for water due to population growth, urbanization, and industrialization has led to significant challenges in water resource management. According to the United Nations, approximately 2 billion people live in countries experiencing high water stress, and this situation is expected to worsen with climate change and increasing consumption patterns. The need for efficient water management strategies has never been more urgent, as inadequate access to clean water and sanitation contributes to the spread of diseases and hampers economic growth.

Water scarcity can arise from both natural and human activities and is assessed based on water quality, quantity, and demand within specific contexts and timeframes (Garcia and Pargament, 2015). It encompasses three key dimensions that may occur independently or in combination: (1) physical or environmental scarcity, (2) economic scarcity, and (3) social or political scarcity. Physical or environmental scarcity relates to the natural availability and quality of water, whereas economic scarcity involves the financial costs associated with water. Social or political scarcity often stems from inadequate water management, access issues, and allocation challenges. Ijoyah (2024) While the first two dimensions can be largely addressed through technical solutions

aimed at optimizing water use, social or political scarcity typically results from ineffective management practices (Manez *et al.*, 2012).

During the 20th century, global water consumption surged by 800%, yet access to safe drinking water remains a significant issue in many regions (Vaz *et al.*, 2017). Unsustainable water use, coupled with rising pollution levels in groundwater and surface water, has diminished overall water availability. Presently, more than 40% of the world's population experiences some level of water scarcity, a figure that continues to rise (United Nations, 2017). Approximately 2 billion people currently live in water-scarce areas, and over 800 million lack adequate access to safe drinking water. Kumar (2024) These circumstances have led to socio-economic tensions related to dwindling water supplies, complicating water management and allocation (Zhou *et al.*, 2017; Nazemi and Madani, 2018). The water resources carrying capacity (WRCC) is affected by climate change and human actions,

Statement of the Problems

The study on socio-economic water consumption in Virudhunagar district highlights several key issues: a lack of comprehensive data on household water usage hampers improvement and conservation efforts; disparities in water usage and hygiene practices between top and bottom HDI blocks necessitate targeted interventions; insufficient understanding of how socio-economic factors influence hygiene practices impacts public health; many households lack awareness of efficient water use and hygiene importance, leading to excessive consumption and poor sanitation; tailored health education programs are needed to address socio-economic differences; and challenges exist in resource allocation and policy design for varying rural household needs. Overall, these issues underscore the urgent need for research and intervention to enhance water management and hygiene practices in the district, promoting better community health and well-being.

Objectives of the Study

The objectives of the study on socio-economic water consumption in the Virudhunagar district include:

- ❖ To investigate the socio-economic profiles of respondents, focusing on factors such as gender, age, educational qualification, marital status, occupation, and family income.
- ❖ To analyze the different categories of water usage in households, including drinking, kitchen, personal hygiene, house cleaning, and for animals.
- ❖ To explore the relationship between socio-economic characteristics and hygiene levels in households, particularly in the top and bottom three blocks identified based on the Human Development Index (HDI).
- ❖ To determine which socio-economic factors significantly influence household hygiene practices and water consumption behaviors.
- ❖ To offer insights and recommendations for improving water usage and hygiene practices based on the findings of the study, particularly targeting areas for potential intervention in education and income-generating opportunities.

Methodology

Virudhunagar district consists of eleven taluks, and for the purpose of this study, six blocks were selected based on the Human Development Index (HDI). The top three blocks identified were Sivakasi, Srivilliputhur, and Rajapalayam, while the bottom three blocks were Vembakottai, Narikudi, and Tiruchuli. These six blocks encompass 54 panchayats and two municipalities. By applying a systematic sampling method, five panchayats were selected, and from each panchayat, 60 respondents were chosen, making a total of 360 respondents from rural areas.

Socio-economic Characteristics of the Sample Respondents

The socio-economic characteristics of the sample respondents are crucial for understanding the dynamics of water consumption, resource access, and overall living conditions. By analyzing factors such as gender, age, educational qualifications, marital status, occupation, and family income, we gain insights into how different segments of the population interact with resources and services. This understanding helps policymakers, development planners, and social scientists design targeted interventions aimed at improving livelihoods, promoting equitable resource distribution, and addressing disparities in income, education, and employment.

Table 1.1 Socio-economic Characteristics of the Sample Respondents

S.No.	Description	Label	Top Three Blocks		Bottom Three Blocks		Total	
			F	%	F	%	F	%
1.	Gender	Male	48	13.33	67	18.61	115	31.94
		Female	132	36.67	113	31.39	245	68.06
2.	Age	Below 20	14	3.89	15	4.17	29	8.06
		20 - 30	66	18.33	44	12.22	110	30.56
		30 - 40	50	13.89	71	19.72	121	33.61
		40 - 50	26	7.22	33	9.17	59	16.39
		Above 50	24	6.67	17	4.72	41	11.39
3.	Educational Qualification	Primary	29	8.06	32	8.89	61	16.94
		Middle	48	13.33	42	11.67	90	25.00
		High School	43	11.94	43	11.94	86	23.89
		Higher Sec School	22	6.11	33	9.17	55	15.28
		Graduate	16	4.44	13	3.61	29	8.06
		Illiterate	22	6.11	17	4.72	39	10.83
4.	Marital Status	Unmarried	57	15.83	71	19.72	128	35.56
		Married	104	28.89	89	24.72	193	53.61
		Divorced	16	4.44	7	1.94	23	6.39
		Widow	3	0.83	13	3.61	16	4.44
5.	Occupation	Education	22	6.11	21	5.83	43	11.94
		Agriculture	33	9.17	26	7.22	59	16.39
		Kooli	37	10.28	50	13.89	87	24.17
		Private	44	12.22	60	16.67	104	28.89
		Business	24	6.67	12	3.33	36	10.00

		Government	20	5.56	11	3.06	31	8.61
6.	Family Income	Below ₹10,000	39	10.83	42	11.67	81	22.50
		₹ 10,000-20,000	99	27.50	94	26.11	193	53.61
		₹ 20,000-30,000	20	5.56	27	7.50	47	13.06
		₹ 30,000-40,000	6	1.67	7	1.94	13	3.61
		₹ 40,000-50,000	4	1.11	7	1.94	11	3.06
		Above ₹ 50,000	12	3.33	3	0.83	15	4.17

Source: Primary data

The socio-economic characteristics of the sample respondents reveal key demographic insights. The sample is predominantly female (68.06%) and mostly consists of individuals aged 20 to 40 years (64.17%). In terms of educational background, the majority have middle school or high school education, though a significant proportion (10.83%) are illiterate. Most respondents are married (53.61%), while 35.56% are unmarried. Occupation-wise, the largest share of respondents is engaged in private jobs (28.89%) or informal labour (Kooli, 24.17%), while a smaller percentage work in agriculture (16.39%) or the government sector (8.61%). The family income data shows that more than half of the households (53.61%) earn between ₹10,000 and ₹20,000 per month, with relatively few earning above ₹ 30,000. In conclusion, the sample represents a population with moderate levels of education and income, with a significant portion working in informal or private-sector jobs. This socio-economic profile highlights areas for potential intervention, particularly in education and income-generating opportunities.

Using of Water in Household Needs

The table 1.2 compares water usage (in liters) across different household needs, broken down by total water use, top three blocks, and bottom three blocks. The categories of water use include drinking water, kitchen, personal hygiene, house cleaning (per week), and animals drinking.

Table 1.2 Using of Water in Household Needs (Per Day)

S.No.	Description	Litters	Top Three Blocks		Bottom Three Blocks		Total	
			F	%	F	%	F	%
1.	Drinking Water	Less than 12.5	21	5.83	10	2.78	31	8.61
		12.5 – 25.0	47	13.06	49	13.61	96	26.67
		25.0 – 37.5	64	17.78	56	15.56	120	33.33
		37.5 – 50.0	29	8.06	54	15.00	83	23.06
		Above 50.0	19	5.28	11	3.06	30	8.33
		Sum	5562.00		5872.50		11434.50	
		Mean	30.90		32.62		31.76	
2.	Kitchen Water	Less than 30	3	0.83	6	1.67	9	2.50

		30 – 45	60	16.67	76	21.11	136	37.78
		45 – 60	77	21.39	70	19.44	147	40.83
		60 – 75	32	8.89	26	7.22	58	16.11
		More than 75	8	2.22	2	0.56	10	2.78
		Sum	9307.00		8758.50		18065.50	
		Mean	51.70		48.65		50.19	
3.	Personal Hygiene	Less than 150	27	7.50	15	4.17	42	11.67
		150 – 200	56	15.56	91	25.28	147	40.83
		200 – 250	69	19.17	61	16.94	130	36.11
		250 – 300	21	5.83	12	3.33	33	9.17
		More than 300	7	1.94	1	0.28	8	2.22
		Sum	36947		35280		72227	
		Mean	205.26		196.00		200.63	
4.	House Cleaning (Per Week)	Less than 150	64	17.78	45	12.50	109	30.28
		150 – 200	56	15.56	58	16.11	114	31.67
		200 – 250	24	6.67	31	8.61	55	15.28
		250 – 300	19	5.28	35	9.72	54	15.00
		More than 300	17	4.72	11	3.06	28	7.78
		Sum	34421		35901		70322	
		Mean	191.23		199.45		195.34	
5.	Animals Drinking	Less than 200	3	5.26	10	17.54	13	22.81
		200 – 400	5	8.77	15	26.32	20	35.09
		400 – 600	4	7.02	8	14.04	12	21.05
		600 – 800	3	5.26	3	5.26	6	10.53
		More than 800	3	5.26	3	5.26	6	10.53
		Total	18	31.58	39	68.42	57	100.00
		Sum	8478		14814		23292	
		Mean	471.00		378.85		408.63	

Source: Primary data

The data on family water usage for drinking reveals distinct consumption patterns between the top and bottom blocks. The highest proportion of families falls within the 25.0 – 37.5 liters range, indicating that a significant number of households consume a moderate amount of water. In the top three blocks, families tend to use more



water overall, reflected in their higher mean of 30.90 liters compared to the bottom three blocks, which have a mean of 32.62 liters. This suggests that families in the top blocks may have better access to water resources or greater water needs. Conversely, the bottom three blocks shows a lower overall usage, particularly with a notable percentage of families using less than 25 liters. This discrepancy could point to limited access to water, economic constraints, or differences in lifestyle and family size. Overall, the data highlights a need for further investigation into the factors contributing to these disparities, particularly focusing on improving water accessibility and addressing the needs of families in the lower consumption categories.

The data on water usage for kitchen-related activities shows notable differences between the top and bottom blocks. The majority of families fall into the 30 – 45 liters and 45 – 60 liters categories, indicating that a substantial portion of households uses a moderate amount of water for cooking and cleaning. In the top three blocks, the mean water usage is 51.70 liters, higher than the bottom blocks' mean of 48.65 liters. This suggests that families in the top blocks may have greater access to water or larger household sizes that require more cooking and cleaning. The percentage of families using less than 30 liters is quite low, with only 2.50% overall, indicating that most households likely have a basic level of water usage for kitchen needs. However, the higher percentages in the 30 – 45 and 45 – 60 liters categories demonstrate a common trend towards moderate usage. The data reflects a need to explore factors influencing these patterns, such as household size, socio-economic status, and access to water resources, to better understand and address the varying needs across different regions.

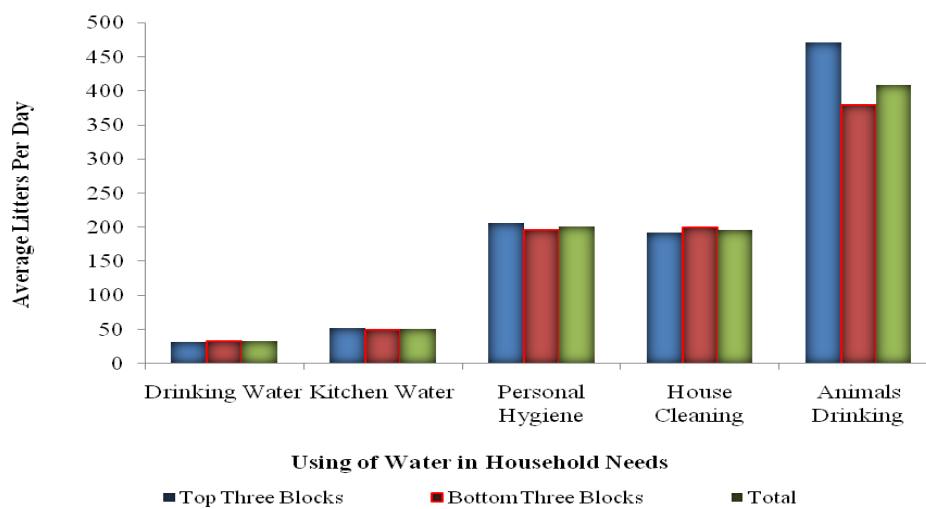
The data on water usage for personal hygiene activities reveals significant patterns in consumption between the top and bottom blocks. A large proportion of families use between 150 to 200 liters and 200 to 250 liters, highlighting that many households maintain a moderate level of water usage for daily hygiene needs. The mean water usage for the top three blocks is 205.26 liters, which is slightly higher than the overall mean of 200.63 liters and notably higher than the bottom blocks' mean of 196.00 liters. This indicates that families in the top blocks likely have better access to water or larger household sizes that necessitate higher consumption for personal hygiene. The low percentage of families using more than 300 liters (only 2.22% overall) suggests that extreme water usage for hygiene is uncommon. Conversely, the highest percentage falls within the 150 – 200 liters category, indicating a common consumption level for many households. Overall, the data emphasizes the importance of personal hygiene in water consumption and suggests a need to examine the factors influencing these variations, including socio-economic status, access to clean water, and cultural practices related to hygiene.

The data on water usage for house cleaning activities indicates varied consumption patterns between the top and bottom blocks. A significant number of families fall into the less than 150 liters and 150 – 200 liters categories, suggesting that many households maintain relatively low to moderate levels of water usage for cleaning purposes. The mean water usage for the top three blocks is 191.23 liters, while the bottom blocks have a higher mean of 199.45 liters. This reversal suggests that families in the bottom blocks may employ more water-intensive cleaning methods or have different cleaning needs that require higher consumption. The percentages for those using more than 300 liters remain low, indicating that extreme usage is not common. The highest proportions are found in the less than 150 liters and 150 – 200 liters categories, reflecting a general trend toward more efficient water use for cleaning. Overall, the data highlights the importance of understanding household practices and access to water when examining cleaning habits. It also suggests that there may be opportunities to promote water-saving strategies, particularly among families with higher consumption rates.

The data on water usage for animals drinking shows notable differences in consumption between the top and bottom blocks. A majority of families in the bottom blocks consume more water for their animals, particularly in the 200 – 400 liters category, where 26.32% of households fall. This suggests that families in these areas may have more animals or larger livestock needs. The mean water usage is significantly higher in the top blocks (471.00 liters) compared to the bottom blocks (378.85 liters). This indicates that families in the top blocks may

have higher overall water needs, possibly due to the types of animals they keep or their management practices. The low percentages of families using less than 200 liters and more than 800 liters suggest that water consumption for animal drinking is generally concentrated within moderate ranges. The data points to a need for further investigation into the factors driving these differences, such as the number of animals, agricultural practices, or access to water resources. Overall, the findings highlight the importance of understanding animal care practices in water consumption and the potential for optimizing water usage in households with varying needs.

Figure 1.1 Using of Water in Household Needs (Per Day)



Level of Hygienic

SD – Standard deviation, are calculated from the score values of 360 respondents. The arithmetic mean and standard deviation are 14.53 and 3.71 respectively.

$$\bar{X} + SD = 14.53 + 3.71 = 18.24 \text{ and above are High level}$$

$$\bar{X} - SD = 14.53 - 3.71 = 10.82 \text{ and above are Low level}$$

$$(\bar{X} + SD) \text{ to } (\bar{X} - SD) = 10.82 \text{ to } 18.24 \text{ are Medium level}$$

Table 1.3 Level of Hygienic

S.No	Level of Hygienic	Top Three Blocks	Bottom Three Blocks	Total
1.	Low	29	30	59
2.	Medium	127	133	260
3.	High	24	17	41
	Total	180	180	360

Source: Primary data

The data on hygiene factors across the top three and bottom three blocks shows a fairly even distribution. The majority of households fall into the "medium" hygiene category, with 260 out of 360 respondents, indicating a

balanced level of hygiene practices overall. The "low" hygiene category represents 59 respondents, almost equally split between the top and bottom blocks, suggesting that hygiene challenges are present in both areas. The "high" hygiene category includes 41 respondents, with slightly more households in the top blocks. This suggests that while hygiene levels are generally moderate, efforts should be directed at improving hygiene standards across both top and bottom blocks.

Socio-Economic Profile of Top Three Blocks and Level of Hygienic

The researcher used the chi-square test to examine the association between the socioeconomic characteristics of the top three blocks of rural families (gender, age, income, occupation, marital status, and educational attainment) and their degree of hygiene. The following null hypothesis has been formulated by the researcher.

“There is no significant relationship between the socio-economic profile of the top three blocks respondents and their level of hygienic”

Table 1.4 Chi-Square Test: Socio-economic Profile of Top Three Blocks and the Level of Hygienic

Variable	Variable	Value	df	Sig. Value	Result
Gender	Hygienic	1.747 ^b	2	0.418	Insignificant
Age		8.710 ^b	8	0.367	Insignificant
Educational Qualification		7.786 ^b	10	0.650	Insignificant
Marital Status		27.528 ^b	6	0.000	Significant
Occupation		7.835 ^b	10	0.645	Insignificant
Family Income		6.164 ^b	10	0.021	Significant

Source: Primary data

The Chi-Square test results highlight key relationships between socio-economic variables and hygiene levels in the top three blocks. Among the variables tested, marital status (0.000) and family income (0.021) show a significant association with hygiene levels, indicating that these factors play a notable role in determining hygienic practices. On the other hand, variables such as gender, age, educational qualification, and occupation do not exhibit a significant relationship with hygiene levels, suggesting that these characteristics have less influence on household hygiene practices in the top three blocks.

Socio-Economic Profile of Bottom Three Blocks and Level of Hygienic

To examine the relationship between the socio-economic profiles (gender, age, educational qualification, marital status, occupation, and income) of households in the bottom three rural blocks and their hygiene levels, the researcher employed the chi-square test. Based on this, the researcher formulated the following null hypotheses.

“There is no significant relationship between the socio-economic profile of the bottom three blocks respondents and their level of hygienic”

Table 1.5 Chi-Square Test: Socio-economic Profile of Bottom Three Blocks and the Level of Hygienic

Variable	Variable	Value	df	Sig. Value	Result
Gender	Hygienic	0.126 ^b	2	0.939	Insignificant
Age		2.543 ^b	8	0.960	Insignificant
Educational Qualification		19.787 ^b	10	0.031	Significant
Marital Status		4.092 ^b	6	0.664	Insignificant
Occupation		8.600 ^b	10	0.048	Significant
Family Income		10.813 ^b	10	0.372	Insignificant

Source: Primary data

The chi-square test results for the socio-economic profile of the bottom three blocks and their hygiene levels reveal that educational qualification and occupation show significant relationships with hygiene levels, as indicated by their p-values of (0.031) and (0.048), respectively. In contrast, gender, age, marital status, and family income exhibit no significant association with hygiene levels, as their p-values exceed the threshold for significance. This suggests that educational background and occupation may play a more critical role in influencing hygiene practices in these blocks.

Suggestions

Based on the water consumption patterns in different household activities, the following suggestions can be made:

1. **Promote Efficient Water Use for Drinking:** A significant portion of households consume between 25.0 to 37.5 liters of drinking water daily. Encouraging water-saving practices, such as the use of filtered water and water-efficient fixtures, can help optimize water use without compromising health.
2. **Kitchen Water Conservation:** With most households using 45 to 60 liters of water in the kitchen, promoting water-saving techniques like reusing water for non-potable tasks (e.g., watering plants) or using water-efficient dishwashers could help reduce this consumption.
3. **Personal Hygiene Awareness:** Since a large number of households use between 150 and 250 liters of water for personal hygiene, water-saving techniques like shorter showers, dual-flush toilets, and water-saving taps can be encouraged to reduce water wastage without sacrificing cleanliness.
4. **Improve House Cleaning Efficiency:** Households consuming more than 200 liters of water for cleaning could benefit from awareness programs on how to clean more efficiently, such as using mops or cloths that require less water, and focusing on weekly cleaning schedules.
5. **Animal Water Consumption Management:** For households with animals, especially those consuming large amounts of water (more than 400 liters), improved management of water resources, including the use of troughs that reduce spillage or rainwater harvesting for animal use, can help optimize water use.
6. **Targeted Interventions Based on Marital Status:** Since marital status shows a significant relationship with hygiene levels, tailored health and hygiene education programs should focus on different marital groups to promote better hygiene practices.

7. **Addressing Income Inequality:** Family income also has a significant impact on hygiene levels. Programs to improve access to hygiene resources in lower-income groups should be prioritized to enhance overall hygiene standards in these areas.
8. **General Awareness Campaigns:** Although gender, age, education, and occupation do not show significant relationships, general awareness campaigns that promote hygiene for all demographic groups can still play a vital role in improving hygiene practices across the population.

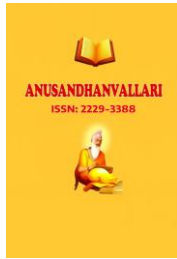
These suggestions aim to reduce overall water consumption while maintaining hygiene and household operations efficiently.

Conclusion

In conclusion, the study of socio-economic water consumption and hygiene practices in the Virudhunagar district of Tamil Nadu highlights the critical interplay between socio-economic factors and water resource management. The findings underscore the urgent need for tailored interventions that address the unique challenges faced by different households, particularly in terms of access to clean water and sanitation. By recognizing the disparities in water usage and hygiene practices among various socio-economic groups, policymakers can develop targeted strategies that promote efficient water use and enhance public health outcomes. Ultimately, improving water management and hygiene standards is essential for fostering sustainable development and ensuring the well-being of communities in Tamil Nadu and beyond.

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