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Consumption and Quality of Domestic Water in Kolhapur City

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Abstract: *This study investigates the patterns of domestic water consumption, public perception of water quality, awareness of rainwater harvesting, and water quality of the Panchganga River in Kolhapur city. Primary data was collected using a structured questionnaire. The findings show that the highest average water consumption per household per day is for bathing (66.9 liters), followed by clothing (41.9 liters). Water consumption varies across economic classes, with higher usage observed in the upper class. Regarding water quality perception, 35.38% of households rated municipal water as excellent, while a significant 40.07% rated it as poor. Alarmingly, only 5% of households were aware of rainwater harvesting, highlighting the need for awareness campaigns*

Keywords: Domestic water consumption; Water quality perception; Economic class analysis; Rainwater harvesting awareness; Kolhapur

I. INTRODUCTION

Water stands as a symbol of life and a crucial natural resource that sustains the intricate web of ecosystems. Water is essential for various aspects of daily life. It supports hydration, facilitates digestion, regulates body temperature, and promotes overall health. Beyond personal health, water is crucial for agriculture, sanitation, and industrial processes, playing a vital role in sustaining life and fostering economic activities. It is the silent hero in our daily lives, meeting essential needs that often go unnoticed. From the moment, we turn on the tap for a morning shower to cooking meals, staying hydrated, and maintaining personal hygiene, water is woven into the fabric of our routines. Its role in quenching our thirst, cleaning, and facilitating various household chores is indispensable.

Rising population and urbanization coupled with climate change may reduce water supply globally during the twenty-first century. India faces challenges regarding water availability due to factors like population growth, uneven distribution, and over-exploitation of water resources. Some regions experience water scarcity, while others face floods. Sustainable water management strategies are crucial to address these issues and ensure reliable access to water for all.

The increasing global population contributes to higher overall water consumption, as more people require water for various purposes. Household water use is influenced by lifestyle, infrastructure, and efficiency. Implementing water-saving technologies and raising awareness can help reduce domestic consumption. Further, the overall quality of water is influenced by pollution from various sources, including industrial discharges, agricultural runoff, and urban activities. As the global population increases, improper waste disposal and contamination contribute to water quality degradation. Polluted water sources pose health risks to human populations. Waterborne diseases, such as cholera, Typhoid, Gastroenteritis, and dysentery, can spread through contaminated water, particularly in areas with inadequate sanitation and limited access to clean water.

Therefore, the objective of this paper is to study the consumption and quality of domestic water in Kolhapur city. To study the pattern of consumption of water for domestic use in Kolhapur city, the primary data is collected through a structured questionnaire.

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The remainder of the paper is as follows: Section 2 provides details of a survey conducted to study the pattern of consumption of water for domestic use in Kolhapur city. Also, Section 2, describes the methods such as sample size determination. Results and discussion are given in Section 3.

II. MATERIAL AND METHODS

It is very difficult to know the details of the actual water consumption viz, drinking, washing of clothes, gardening, dish washing, cooking, bathing, toilet flushing, and house cleaning. Therefore, to study the pattern of consumption of water in each household in Kolhapur city for the above-mentioned activities, the primary data is collected. The details of the survey are as follows: First, we took the list from the Municipal Corporation Office, Kolhapur of all the households which has the Municipal Corporation water connection (We call it a sampling frame. It is defined as a list of elements or groups of elements on which the observations are taken.). There are a total of 1,18,190 domestic water connections in the city. Which is the population size (N). Further, the sample size is determined using the formula provided by Yamane (1967) and it is as follows:

$$n = \frac{N}{1 + Ne^2}$$

where n is the sample size and e is the level of precision. Here, e has chosen 6%.

$$n = \frac{118190}{(1 + (118190 \times 0.06^2))}$$

$$n = 277.1265$$

Therefore, the sample size (n) is 277. Furthermore, the data is collected using the simple random sampling method (without replacement). It is the method of selection of units by giving equal chance to all the units in the population. For this, we have given numbers from 1 to 1,18,190 to all the households in the population. Further, generated the random number between these two numbers in Excel. Then, the data of that household is collected through the questionnaire. The questionnaire contains 27 questions on daily and activity-wise consumption of water, quality of water, duration of water, and the level of awareness about rainwater harvesting technology.

Also, our interest is to study the pattern of water consumption according to the income of the households. However, people are not likely to provide their actual income. Therefore, we assigned certain weights to the assets possessed by households, and by summing up the scores for each asset, the asset score for a household was arrived at. The assets for which data is collected and the weights assigned to them are as follows: four-wheeler/car (weight 5.0), refrigerator (2.0), washing machine (2.0), microwave oven (2.0), two-wheeler (1.5), television (0.5), mobile phone (0.5), and radio (0.25). The following ranges of asset scores were used to classify the households into four different economic/asset classes.

a. **Poor Class**: asset score between 0.01 to 0.99.
b. **Lower Class**: asset score between 1.00 to 4.99.
c. **Middle Class**: asset score between 5.00 to 9.99.
d. **Upper Class**: asset score 10.00 and above.

III. RESULTS AND DISCUSSION

In this section, first, we will see the pattern of domestic water consumption in Kolhapur for different activities and different economic classes, the perception of households about the quality of water, and the awareness of households about rainwater harvesting.

Table 3 shows the average water consumption (in liters) per household per day for various activities in Kolhapur city along with the *standard deviation* (SD) representing the variability in water usage for each activity. The average amount of water typically consumed per household for drinking is 11.4 liters/day. Similarly, 41.9 liters/day of average water is consumed for washing clothes per household. Further, the average water consumed (in liters/day) for other activities such as gardening, dishwashing, cooking, bathing, toilet flushing, and house cleaning is 3.7, 27.1, 6, 66.9, 33.1, and 14.6,

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respectively. It is observed that maximum water is consumed for bathing activity followed by clothing activity. Also, the table shows the total amount of water consumed for each activity per day in Kolhapur city.

Table 3: Activity-wise distribution of water consumption (in liter) per household per day in Kolhapur city

Activity	Mean	SD	Total*
Drinking	11.4	07.03	1343184.54
Clothing	41.9	30.87	4949472.93
Gardening	03.7	07.63	440332.42
Dish Washing	27.1	17.19	3198383.54
Cooking	06.0	03.26	712980.11
Bathing	66.9	37.19	7905502.96
Toilet Flushing	33.1	21.07	3914777.08
House Cleaning	14.6	11.19	1731462.17

** Total: Total water consumed for each activity per day in Kolhapur city. It is computed by taking the product of the average water consumed for an activity and population size.*

Table 4 shows the average water consumption (in liters) for various activities across different economic classes. Each row represents a specific activity, and the columns represent different economic classes. The average water consumption on drinking increases as we move from the poor economic class to the upper economic class. The upper economic class tends to consume more water in all the activities compared to the other economic classes. Poor economic class does not engage in gardening activity. Overall, the table gives a snapshot of how different economic classes consume water for various activities.

Table 4: Activity-wise and economic class-wise distribution of average water consumption (in liter) per household per day in Kolhapur city

	Economic Class			
Activity	**Poor**	**Lower**	**Middle**	**Upper**
Drinking	09.5	11.0	11.0	12.7
Clothing	33.3	42.1	39.6	45.1
Gardening	00.0	02.7	03.2	06.8
Dish Washing	20.0	25.5	27.2	30.8
Cooking	05.5	05.4	06.5	06.8
Bathing	52.5	66.2	64.3	73.1
Toilet Flushing	21.7	28.7	32.4	44.3
House Cleaning	12.5	12.2	14.2	20.5

We also studied the perception of households about the quality of municipal water. During the survey, we asked people to give ratings about the quality of water on the following scales: Excellent (Water is of exceptional quality, clean, and safe for consumption), Good (Water quality is satisfactory, with minor concerns), Average (Water quality is neither notably good nor bad, with room for improvement), Poor (Water quality is below acceptable standards, posing health risks), and Very Poor (Water quality is severely compromised, presenting significant health hazards). Table 5 shows the count and proportion of households in each rating. The excellent rating represents the largest proportion of households, accounting for approximately 35.38% of all ratings. This indicates that a significant portion of households view the quality of water as Excellent, that is, water is of exceptional quality, clean, and safe for consumption. The Good rating comprises a very small proportion of responses, making up approximately 1.44% of the total. This suggests that only a small minority of households find the water quality satisfactory, with minor concerns. The average rating constitutes about 14.08% of households, indicating that there is a moderate-sized group of households who perceive the water quality

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to be average or moderately satisfactory. Further, the Poor represents the largest proportion of negative ratings, the Poor category accounts for approximately 40.07% of households. This suggests that a significant portion of households have concerns or dissatisfaction with the quality of water. Finally, the Very Poor rating represents a smaller proportion of households, comprising approximately 9.03% of the total. While smaller than the Poor category, it still indicates a notable level of dissatisfaction or concern among households regarding water quality.

Table 5: Rating on quality of water

Rating	**Count**	**Proportion**
Excellent	98	0.3538
Good	4	0.0144
Average	39	0.1408
Poor	111	0.4007
Very poor	25	0.0902

Further, we also conducted a survey to see the awareness of households about rainwater harvesting. Because rainwater harvesting can play an important role in meeting water supply challenges, it is a process of collecting and storing rainwater for various uses. Table 6 shows the proportion of awareness of households about rainwater harvesting in Kolhapur city. With only a mere 0.05 proportion of households being cognizant of this sustainable practice. The overwhelming majority, comprising 0.95 proportion, remain unaware of the potential benefits and importance of rainwater harvesting. This indicates a potential need for awareness campaigns or education programs to promote rainwater harvesting in Kolhapur city.

Table 6: Proportion of awareness of rainwater harvesting	
Yes	0.05
No	0.95

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1. Yamane, Taro. 1967. *Statistics, An Introductory Analysis*, 2nd Ed., New York: Harper and Row.