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Drinking Water Quality Awareness level of Birendranagar City Area, Surkhet District, Karnali Province, Nepal (A Case Study of Jhupra Khola WSP)

Pappu Kumar Raut[1], Ramesh Subedi[2]

[1]*Student, Graduate School of Engineering, Central Department of Civil Engineering, Mid-West University, Birendranagar, Surkhet*

[2] *Senior Divisional Engineer, Ministry of Physical Infrastructure and Urban Development, Karnali Province*

Abstract - This paper evaluated the public's level of awareness on drinking water quality in Birendranagar City (Surkhet Valley), Surkhet District, Nepal, specifically focusing on users of the Jhupra Khola Water Supply Project. Using a survey of 96 respondents, the study employed descriptive statistics and Spearman rank correlation analysis. The study found a moderate general level of water quality awareness (mean=3.45, SD=0.52). The results showed that survey respondents exhibited high awareness related to both the sensory quality (such as color, odor, taste, and visible particles in the water) and the severity and experience of water quality issues. Respondents demonstrated moderate awareness in relation to practices and sources of drinking water, including frequency of supply, drinking tap water, and water treatment. Furthermore, correlation analysis indicated positive relationships; for instance, there was a very strong association between a consistent interval of supply and drinking tap water (r = 0.865). Perceptions of water quality issues were associated most strongly with water color (r = 0.887). However, preventive practices (covering water containers, treatment of water) exhibited little or no correlation with the sensory quality of the supply. In conclusion, the research has identified that baseline knowledge of water aesthetics in the area is high but recommends additional educational approaches to promote awareness of and to apply protective water management and treatment practices within the community.

Key Words: *Water Quality Awareness, Birendranagar, Sensory Properties, Safe Water Practices*

1. INTRODUCTION

Access to water and sanitation is a basic human right. United Nation, through Resolution 64/292, has recognized the human right to water and sanitation in 2010 [1]. The Constitution of Nepal 2015 enshrines that access to safe drinking water and improved sanitation is a fundamental right of the people [2]. Sustainable Development Goal (SDG) 6 is achievement of clean water and sanitation for all. Access to safely managed drinking water and sanitation services and hygiene are foundations of human health, well-being, socio-economic development, and human dignity. While substantial progress has been made in increasing access to clean drinking water and sanitation, billions of people, mostly in rural areas, still lack these basic services. Worldwide 1 in 4 people lack access to safely managed drinking water services and nearly 1 in 2 people lack access to safely managed sanitation facilities [3].

According to [4] in Nepal, water flow adequacy for 8 million people is tiered: 44.7% have enough for all needs, 31.8% for drinking, cooking, and washing, and 14.2% have just enough for drinking. Critically, 4.8% have water insufficient for drinking, and 4.3% have no water at all.

Similarly, based on [4] in Karnali Province only 24.2% have water sufficient for all daily needs. A larger segment, 41%, has enough for drinking, cooking, and washing, while 19.1% report it is just sufficient for drinking. A concerning 6.7% have water that is insufficient for drinking, and 8.7% have no water at all.

[4] Birendranagar Municipality reveals a critical water scarcity issue. While the majority of water points (46.5%) provide water that is just sufficient for drinking, they serve nearly half the population (47.8%). Only 6.4% of taps provide water sufficient for all daily needs, serving a mere 5.7% of the population. A significant 11.4% of taps have water insufficient for drinking, and 3.9% are completely dry, collectively affecting over 16% of the served population.

So that population majority of Karnali Province in Birendranagar city depends upon water supply from Surkhet Valley Water Supply Project (Jhupra Khola Brihat WSP). Some house hold depends upon their own underground water (hand pump) also [5]. The chemical & biological parameter of drinking water affects significant to the public health also. Some chemicals, notably iron, ammonia, nitrates and arsenic have adverse health impacts. The present study has been designed to find drinking water quality awareness level of water user's of Jhupra Khola Brihat WSP in Birendranagar Municipality (Surkhet Valley).

1.2 Research Question

Research problem can be presented as follow:

a. What is the current level of public awareness regarding water quality and safe drinking water practices among water users in Birendranagar City (Surkhet Valley)?

The specific objective of this study is as follows.

a. To find the Water Quality awareness level of public (water user) in Birendranagar City area (Surkhet Valley).

2. LITERATURE REVIEW:

Awareness and perception of drinking water quality are issues of global importance that show great variation between and within nations.

A prolonged study in the Pacific Northwest region of the USA found, for example, more than 78% of residents considered their drinking water safe over the 32 years of follow-up. However, perceived safety is in decline; the safety perception dropped from 92.8% in 1998 to less than 79% in 2019, which indicates growing public concerns [6]. In Mogadishu, Somalia, seen in another study, a sample of residents found 71.7% of respondents agreed that good drinking water quality was important, while the survey reports 32.1% ranked their drinking water quality as "Good," suggesting a generally positive perception [7]. Research focused on rural Amazonian populations living in Para-Brazil, 63.1% of interviewees perceived the drinking water quality as "organoleptically altered", or poor [8]. Nearly 94.8% / 95% recognized the linkage between declining drinking water quality and increasing health problems, signaling tremendous concern regarding drinking water quality issues. Other studies done in Kenya and Fiji had documented the knowledge, attitudes, and perceptions of the local populations regarding to drinking water quality levels and healthcare impacts on their community [9, 10]. In business students, a study found that drinking water safety awareness is a category of concern, concluding that approximately 66 % of the respondents indicated they were paying special attention, or rather high attention, to drinking water quality and incidents of contamination [11].

Research from several places within South Asia repeatedly highlights serious water quality issues impacting public perception. In India alone, research in different locations consistently highlights concerns. An analytical study of urban drinking water in Dimapur, Nagaland uncovered that 40% of samples tested were polluted, what must concern public health [12]. Assessments in an industrializing town in North India reported water quality to be poor and non-drinkable based on calculated water quality index values exceeding acceptable levels out of sight [13]. For the locality of Sonitpur in rural Assam, groundwater quality was above acceptable limits for multiple parameters posing health concerns [14]. A study that explored the link between perceptions around tap water, and consumption of bottled water, for example, noted that 75.72% of respondents perceived the tap water was unacceptable, and there is a significant disconnect between public perceptions and tested water quality [15]. Lastly, in District Mandi, Himachal Pradesh, another source highlighted room for improvement in water sources to ensure a safe supply [16].

In Bangladesh, perceptions and awareness are also inconsistent. An evaluation of groundwater in Khulna City found that just 11.86% of samples were "excellent"; 23.73% were "poor"; 1.69% were "very poor"; and 8.47% were "unfit" for drinking, all of which suggest differing perceptions of quality of water [17]. The authors of a study conducted in Goalmari indicated that socio-economic factors (i.e., awareness, willingness, and ability to pay) were the main drivers influencing household selection of water sources and perceptions of utility [18]. In a cross-sectional survey in rural Bangladesh, respondents also demonstrated discrepancies in perception and practice: 65.6% of 110 respondents felt drinking water was safe based on organoleptic properties, yet 70.4% consumed unfiltered tube well water [19]. In Karachi, Pakistan tap water was found to be poor, and only a small part of the water supply was safe for drinking, which had health implications for the public and contributed to public perception about water quality [20].

Research in Nepal indicates clear regional differences regarding both quality of water and public perception. Numerous studies have examined harms related to municipal supply quality. An assessment across three Nepalese locations noted that Kathmandu had the lowest quality of drinking water and Kaski had the highest, indicating that public perception of the quality of drinking water may differ across locations in Nepal [21]. Evaluations of municipal water in Kathmandu District noted that it is not safe to drink without filtration and purification, indicating that the public likely perceives it as poor quality [22]. Analyses in Pokhara note a more mixed situation. In one study it was determined that drinking water quality in the Mardi Watershed was generally acceptable, though concerns regarding high microbial presence warranted good management practices [23]. In another study, quality of drinking water was rated as poor, especially during the monsoon season when turbidity and microbial presence were considered problematic, and treatment of drinking water would be recommended for safety; In addition, a microbiological study conducted in Pokhara found significant contamination that would likely lead to a very poor public perception of safety [24]. Awareness and perceptions at the community level can be positive, even when households report problems. In Bhimdatta Municipality, for example, while 56.2% of households rated the drinking water quality as good and 26.4% as excellent, they also cited problems with taste, odors, and turbidity [25]. An assessment of drinking water quality and safety in Baglung Bazaar found, however, that people did not find the water quality to be acceptable nor is it safe to drink straight from the tap. This assessment negatively affected public perception about the quality of public drinking water [26]. Collectively, these studies show that awareness and perception of drinking water quality in Nepal is highly localized and is determined by the actual quality of water sources and the lived experience of the communities dependent on those sources.

3. METHODOLOGY:

3.1 Study Area

The Surkhet district is one of 10 districts of Karnali Province of Nepal. Which is 600 KM from capital city Kathmandu. It is located 80°59' to 82°02' east longitude and 28°20' to 28°58' north latitude. It is stated 198m. to 2367 m. height from sea level. It covered 2451 sq. KM; out of that, the geographical pattern is structured by 13 percent plain valley, mid hill or mountain 42 percent & 43 percent high hill. The study area is selected Birendranagar City (Surkhet Valley). Birendranagar City is in Surkhet District Karnali Province, Nepal. It is the capital city of Karnali province as well as the district headquarter of Surkhet district. The municipality was established in 2033 BS. It is bounded by Guranse Rural Municipality of Dailekh district in the north, Bheriganga Municipality in the south, Barahtaal Rural Municipality in the west and Lekbesi Municipality and the Jhupra River in the east. Birendranagar has total 16 wards, which are scattered across 245.06 square kilometers of geographical area. It is the 17th most populous city of Nepal. Birendranagar is the largest city of Karnali province and 7th largest in Western Nepal.

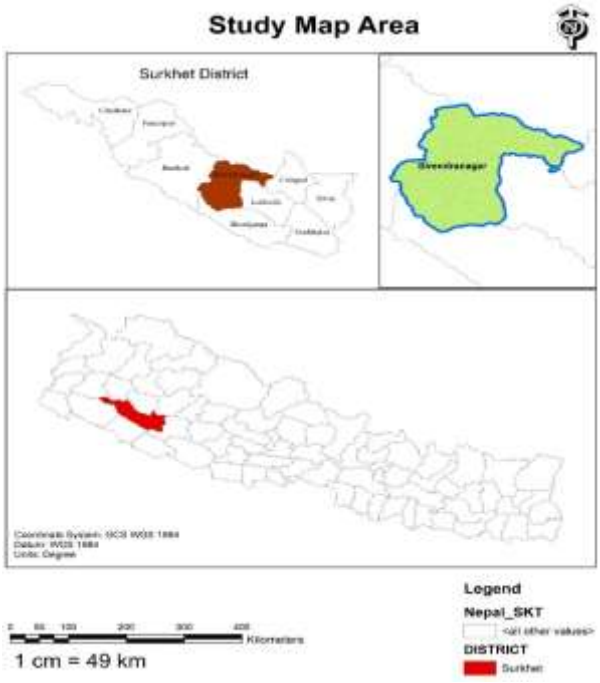

Fig -1: Study area, Birendranagar Municipality

Fig -2: Birendranagar Municipality showing ward boundary

The total population of the Birendranagar Municipality is 153863 with 75129 males and 78734 females and households of 38377 [5]. It is the 17th most populous city of Nepal. Birendranagar is the largest city of Karnali province and 7th largest in Western Nepal. The total population of the Birendranagar Municipality is 153863 with 75129 males and 78734 females and households of 38377 [5]. The population density in Birendranagar Municipality varies greatly. The highest population density (i.e., 19619) is in Ward no 3 which is the core city area while the lowest is in Ward no 15. The wards with low population density cover the rural areas in the northern part of the municipality.

3.2 Data Collection Methods

Field Observation (FO)

Field observation is a method of collecting data from field in 'real' locations and situations, such as workplaces, homes through self-observation. In this study, different location of Jhupra Khola Brihat WSP as source, treatment plant, reservoir & service delivery point (user tap) in Birendranagar Municipality observed physically to collect necessary data.

Questionnaire Survey

The sample size was determined based on non-probability snowball sampling. Questionnaire survey is a very efficient tool to collect necessary information from the HH respondents through a set of closed ended questions.

In this study, a set of well-planned and structured questionnaires was prepared, and it was used to get the responses from 100 randomly selected user household from ward no 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 & 13 in Birendranagar Municipality. All the data were collected by free of consent to all the respondent, the hard copy of all the check list given to the respondent and finally ticked on the answer.

3.3 Data Analysis and processing.

Data Analysis

Data were analyzed by means of table and diagrams and percentage rate. The descriptive statistical analysis & correlation statistical analysis by using Excel & SPSS version 25 software.

Likert Scale:

A Likert scale with five points (1-5) having two positive options, two negative options and one neutral option were used to analyze the water users' responses about water supply frequency, water usage practices, perception of water quality and water treatment practice. In order to have a uniform measurement across different variables (N=10), each category response was coded with a number that ranges from 1 (very low) to 5 (very high). This method allowed the computation of average scores that were linked to five levels: very low, low, moderate, high, and very high. The use of such conversion also enabled the evaluation of the level of the people's awareness of drinking water quality.

4. RESULTS AND DISCUSSIONS:

4.1 Response Rate

One hundred (100) questionnaires were administered to the water users, but ninety-six (96) were retrieved, representing a response rate of 96%. The study therefore realized a response rate of 96% which was valid to be used. The researcher could not attain a 100% response rate because a few of the water users did not return their questionnaires after several attempts were made to retrieve them. Besides, some of the questionnaires returned were not answered while others had incomplete answers that were eliminated from the analysis. Nevertheless, this rate of data response was considered suitable based on the recommendation of [27] that "a response rate

of 50% is enough in a survey." The response rate obtained in this study was, therefore, very good. The next section presents the demographic characteristics of water users.

4.2 Demographic Characteristics

The demographic characteristics of the respondents such as gender, age range, type of family, educational qualification, profession, yearly family income, no. of member in HH & water drink per person per day of water users were examined and the results are accessible in Table 1.

Table 1: Demographics Information of Water User (N = 96)

Variable	Category	Frequency	%
Gender	Male	35	36.5
	Female	61	63.5
	Total	96	100.0
Age range in year	18-24	13	13.5
	25-34	28	29.2
	35-44	36	37.5
	45-54	14	14.6
	55 & above	5	5.2
	Total	96	100.0
Type of Family	Joint	28	29.2
	Nuclear	68	70.8
	Total	96	100.0
Educational Qualification	Illiterate	6	6.3
	Primary Level	12	12.5
	Secondary Level	18	18.8
	+2 Level/PCl	24	25.0
	Bachelor	33	34.4
	Master and above	3	3.1
	Total	96	100.0
Profession	As it is stay at home	4	4.2
	Farmer	13	13.5
	Teacher	22	22.9
	Gov. Job	25	26.0
	Businessman	18	18.8
	Other	14	14.6
	Total	96	100.0
Number of people in house hold	1-4 Nos	31	32.3
	5-8 Nos	42	43.8
	9-12 Nos	17	17.7
	13 Nos and above	6	6.3
	Total	96	100.0
Yearly family income range	Below NRs. 1,00,000.00	6	6.3
	Between NRs. 1,00,000.00-3,00,000.00	15	15.6
	Between NRs. 3,00,000.00-5,00,000.00	32	33.3
	Above NRs. 5,00,000.00	43	44.8
	Total	96	100.0
Water drink per day per person	1 ltr.	4	4.2
	1.5 ltr.	8	8.3
	2 ltr.	25	26.0
	2.5 ltr.	38	39.6
	3 ltr.	13	13.5
	More than 3 ltr.	8	8.3
	Total	96	100.0

(Source Field Survey 2025)

The socio-demographic study of 96 water users of Birendranagar Municipality shows a varied demographic posture. Most participants were female (63.5%), and most participants were aged 35-44 years (37.5%) with nearly half of them being middle-aged adults. A majority of the respondents came from nuclear families (70.8%) and many lived in a household with members that varied between 5 to 8 individuals (43.8%). The community is relatively educated, with more than half of the population holding a Bachelor's degree or above (34.4% and 3.1%, accordingly). By profession, government workers (26.0%) and teachers (22.9%) were the most common professional groups represented in this study. Economically, substantial proportion reported reasonable yearly family income (44.8% above NRs. 5,00,000.00). With respect to water drinking behavior, the majority should be emphasized on daily per capita (2.5 liters or 39.6%) as it implied a fair knowledge of hydration requirement.

4.3 Cronbach's Alpha for Reliability Test

The research instrument's reliability was evaluated using Cronbach's Alpha, which is a measure of the internal consistency of a 10-item questionnaire that aims to measure the awareness level of water users. The calculation resulted in a Cronbach's Alpha coefficient of 0.779. Based on the most commonly used criteria, this score lies within the range from good to acceptable reliability, thus indicating that the items have a satisfactory level of internal consistency [28]. If the value is above 0.7, it is usually interpreted that the items are somewhat interconnected and they are measuring the same latent feature, in this case, water awareness. This finding leads to the assumption that the survey data from Birendranagar Municipality can be used for further analysis and interpretation of the study objective with a high level of confidence.

4.4 Water Quality Awareness Level of Water User's.

The findings of the awareness level of water users on Water Quality in Birendranagar Municipality was guided by research question one - What is the current level of public awareness regarding water quality and safe drinking water practices among water users in Birendranagar City (Surkhet Valley)? This research question aimed to find the awareness level of public (water user) in Birendranagar City area (Surkhet Valley). In this study, the standard deviation and mean were considered to establish the level of awareness regarding Water Quality, such that mean <2.50 showed a low level of awareness, 2.50≤ mean <3.50 showed a moderate level of awareness, and mean ≥3.50 indicated a high level of awareness. These categorizations are consistent with (Nunnally and Bernstein). These, scholars maintain that the mean score on a 5-point Likert scale questionnaire, the mean score can be ranked as "very low", "low", "moderate", "high" and "very high". "Very low" and "low" are merged to "low", while "high" and "very high" are considered "high". The "moderate" is maintained. The general understanding of water users on their awareness level of Water Quality is shown in Table 2.

Table 2: Descriptive Statistics on Water Quality awareness level of Water User

Statement	N	Min.	Max.	Mean	Std. Dev.	Level of Water Quality Awareness
Water supply interval	96	1	5	2.96	1.450	Moderate
Use of tap water for drinking	96	1	4	2.69	0.921	Moderate
Regular drinking water source	96	1	4	3.09	1.197	Moderate
Color of tap water	96	2	4	3.72	0.593	High
Odor in tap water	96	1	4	3.91	0.461	High
Visible particles in water	96	3	4	3.98	0.144	High
Taste of tap water	96	3	4	3.97	0.175	High
Covering water container	96	1	4	3.47	0.973	Moderate
Water treatment practice	96	1	4	3.17	1.185	Moderate
Issues experienced in water quality	96	1	4	3.59	0.901	High

(Source Field Survey 2025)

Table 2 showed that water users had moderate level of Water Quality awareness in relation to awareness of water supply interval (M=2.96, SD=1.45), awareness of use of tap water for drinking (M=2.69, SD=0.921), awareness of regular drinking water source (M=3.09, SD=1.197), awareness of covering water container (M=3.47, SD=0.973), awareness of water treatment practice (M=3.17, SD=1.185) while awareness of the color of tap water (M=3.72, SD=0.593), awareness of odor in tap water (M=3.91, SD=0.461), awareness of visible particles in water (M=3.98, SD=0.144), awareness of taste of tap water (M=3.97, SD=0.175), awareness of issues experienced in water quality (M=3.59, SD=0.901) were high. Overall, it could be realized that Birendranagar Municipality (Surkhet Valley) had a "**Moderate level"** (M=3.45, SD=0.52) of Water Quality awareness. The findings suggested that the mean scores for the indicators of Water Quality awareness were higher than the 3.0 mean score of the questionnaire (1+2+3+4+5/5). From this study, water quality awareness was at a high level in 56.3% of the water user, while 40.6% were at a moderate level. It can be inferred that the majority of the community (96.9%) was at least moderately aware of the issue as those with low awareness (3.1%) were only a very small number.

From the Table 3 the correlation coefficient serves as a measure to evaluate the extent to which two variables change together. The main thing to keep in mind is that very strong correlation, however large, will not automatically imply that one of the variables is the reason for the change of the other. Rather, it only signifies that a link between the two exists [29]. Correlations ($|r| > 0.3$) stronger than those analyzed reveal patterns distinct from water quality awareness and practice. Particularly, a very strong positive association was found between the regularity of the water supply interval and the use of tap water for drinking ($r = 0.865$), suggesting that the consumption of good water was the main factor of reliable access.

Table 3: Spearman Correlation coefficient values between variables of Water Quality awareness

Variables	Water supply interval	Use of tap water for drinking	Regular drinking water source	Color of tap water	Odor in tap water	Visible particles in water	Taste of tap water	Covering water container	Water treatment practice	Issues experienced in Water Quality
Water supply interval	1.000									
Use of tap water for drinking	**0.865**	1.000								
Regular drinking water source	**0.651**	**0.762**	1.000							
Color of tap water	**0.464**	**0.608**	**0.734**	1.000						
Odor in tap water	0.246	0.327	0.226	**0.596**	1.000					
Visible particles in water	0.198	0.269	0.134	**0.425**	**0.925**	1.000				
Taste of tap water	0.202	0.265	0.215	**0.523**	**0.747**	**0.812**	1.000			
Covering water container	0.141	0.059	0.116	0.103	0.005	-0.080	-0.099	1.000		
Water treatment practice	0.292	0.231	0.219	0.007	0.010	0.021	-0.025	-0.041	1.000	
Issues experienced in Water Quality	**0.454**	**0.619**	**0.689**	**0.887**	**0.516**	**0.422**	**0.520**	0.039	-0.005	1.000

(Source Field Survey 2025)

Moreover, a raising of standards for drinking water was further positively associated with being the regular source of drinking water ($r = 0.762$), which, as it were, was very largely associated with the perceptions of its quality, especially the color of the water ($r = 0.734$). Water's sensory characteristics were very closely related, with the strong positive correlations between its color, odor, and the presence of visible particles. For example, a stronger odor was very closely associated with more visible particles ($r = 0.925$), and both being positively correlated with negative taste (odor and taste: $r = 0.747$; particles and taste: $r = 0.812$). Not surprisingly,

the perception of issues that have arisen in water quality was very strongly and positively led by the color of the water (r = 0.887) and also, positively related to the use of tap water for drinking (r = 0.619) and having it as a regular source (r = 0.689). Interestingly and in contrast, there were no strong negatively correlated pairs (r < -0.3) present in the data. The weakest relationships were all close to zero, indicating that activities such as covering water containers and water treatment, which were largely independent of the observed sensory properties of the water supply, are not influenced by the water sensory properties.

5. CONCLUSIONS:

The public understands that water is, on average, of moderate quality, but this is based on the water's sensory properties as opposed to any real knowledge of the water's condition. The level of awareness regarding water quality was **"moderate"** at (Mean=3.45, SD=0.52), while 56.3% of users had a high level of awareness and 40.6 had a moderate level. The most important piece of information affecting users' knowledge was the sensory properties of water and they were highly correlated with each sensory indicator (color, odor, visible particles (r > 0.73) and predicted water quality issues (Color: r= 0.887); the research has identified that baseline knowledge of water aesthetics in the area is high but recommends additional educational approaches to promote awareness of and to apply protective water management and treatment practices within the community.

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