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ASSESSMENT OF WATER POVERTY SITUATION IN BALOCHISTAN PROVINCE OF PAKISTAN: A CASE STUDY OF TWO TEHSILS OF DISTRICT QUETTA

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ABSTRACT

Water is essential to the survival of human beings and also for cleaning and agriculture. Pakistan being a developing country and facing water poverty. This study was conducted to analyze the water poverty status of city and Saddar tehsil of district Quetta. A water poverty index (WPI) was used to calculate the water poverty. A total of 400 participants were selected, including 300 from Quetta city tehsil (QC) and 100 from Quetta Saddar tehsil (QS). A proportional sampling technique was used to sample the participants of the study. Study design used was a descriptive one with the data being collected on structured questionnaire. Apart from the primary data, secondary was gathered from the WASA department located in Quetta. Data on the water poverty status showed that majority of the people from both tehsils (47.67% in QC and 41% in QS) were dependent on pipped water supply as their primary water source. The rest of the population were either dependent on community well (32.33% in QC and 28% in QS), borewell (11% in QC and 26% in QS) or tanker water (9% in QC and 5% in QS). Almost 90% of respondents from both tehsils reported to be using tanker water in case of water shortage from piped water supply. Interestingly, only 45.33% of respondents from QC reported clear water with no contamination while 75% respondents from QS enjoyed a clear water. Water poverty situation was found to be present in both QC and QS tehsil. Not only was water supply short but also contaminated with disposal. The development of a good policy is required for resolving the issue of water poverty in the two tehsils of Quetta.

KEYWORDS: Water Poverty, Proportional sampling, Quetta, Baluchistan

1. INTRODUCTION

Water is an essential component for human survival. Water usage has increased throughout the world due to population growth. Access to sufficient clean water is critical for human health, economic development, food security, and environment preservation (Komnenic, Ahlers, & Van Der Zaag, 2009; Programme, 2003). Many studies have emphasized the significant correlation between water availability and poverty reduction, despite the fact that the causes of poverty and their relationship to water

are extremely complicated (Harrington et al., 2009; Komnenic et al., 2009). Water concerns have risen to the top of many national and international agendas as a result of the global water scarcity issue and a recurring discourse by international organizations highlighting the significance of water in the fight against poverty. Because water plays such an important part in human life, it is inextricably linked to poverty and is frequently perceived as a violation of human rights and dignity (Molle & Mollinga, 2003).

Inadequate water-related service supply in developing countries continues to jeopardize poverty-reduction efforts. Despite the fact that Pakistan, the world's sixth most populated country, is well-endowed with water, water availability per person is relatively low. Climate change is posing severe difficulties to traditional agricultural communities, such as those seen in many regions of rural Pakistan. In regions where traditional agricultural techniques have been practiced for centuries, changing weather patterns are shortening the planting season and generating significant water shortages. According to studies, the possibility of water shortage caused only by climate change in Pakistan is more than 90%, potentially reducing water availability by more than 10% (Vinke et al., 2017). Many of these agrarian communities in Pakistan are increasingly relying on irrigation systems in the form of carefully constructed canals to maintain their livelihoods during water scarce periods (Latif, Haider, & Rashid, 2016).

Even in areas where people have adequate access to water resources through irrigation canals or advanced water pumping systems, many other criteria must be used to determine how water poor an area is (Komnenic et al., 2009). The developing world is also dealing with the consequences of fast industrialization without appropriate environmental impact assessment. Further, groundwater abstraction far outpaces replenishment, resulting in enormous resource loss, particularly in water-scarce areas of Pakistan like Balochistan (Syed Mohammad Khair, Mushtaq, & Reardon-Smith, 2015). Balochistan's climate varies from semi-arid to hyper-arid and has geographically dispersed rainfall and with significant evaporation rates. The province has 23% of Pakistan's water resources. However, due to strong stream slopes, the majority of the water flows quickly (Bhatti, Khattak, & Roohi, 2008). Similarly, Shah (2003) reported that, while the agriculture sector in the region is heavily reliant on irrigation water, farmers are experiencing acute water shortages due to overexploitation and mismanagement.

Pakistan is rapidly progressing from a water scarce to a water stressed state, and within a decade, a water famine state. Pakistan's per capita water availability has decreased from 5600 cubic meters in 1947 to 1200

cubic meters in 2005, and was rapidly nearing the 1000 cubic meter threshold against a water threshold of 1,800 cubic meters per capita in 2015 (Iqbal & Iqbal, 2015). Balochistan is Pakistan's least water-secure province; water availability per ha/year in Balochistan was around 560 cubic metres, far less than the national average of 2,500 cubic metres (Akhtar et al., 2021). Keeping in view the above literature on water poverty in Balochistan, this study was aimed to address the water poverty situation in City and Saddar tehsils of Quetta in Balochistan province of Pakistan.

2. MATERIAL AND METHODS

2.1 Study area

Balochistan province is located in Pakistan's southwest corner. It is located between the latitudes of 24°, 53’ and 32°, 05’ north and the longitudes of 60°, 52’ and 72°, 18’ east (Khalid, 2019). It has a wide agro-ecological range, which is divided into four agricultural and climatic zones: highlands, deserts, plains, and coasts (Syed M Khair, Mushtaq, Culas, & Hafeez, 2011).

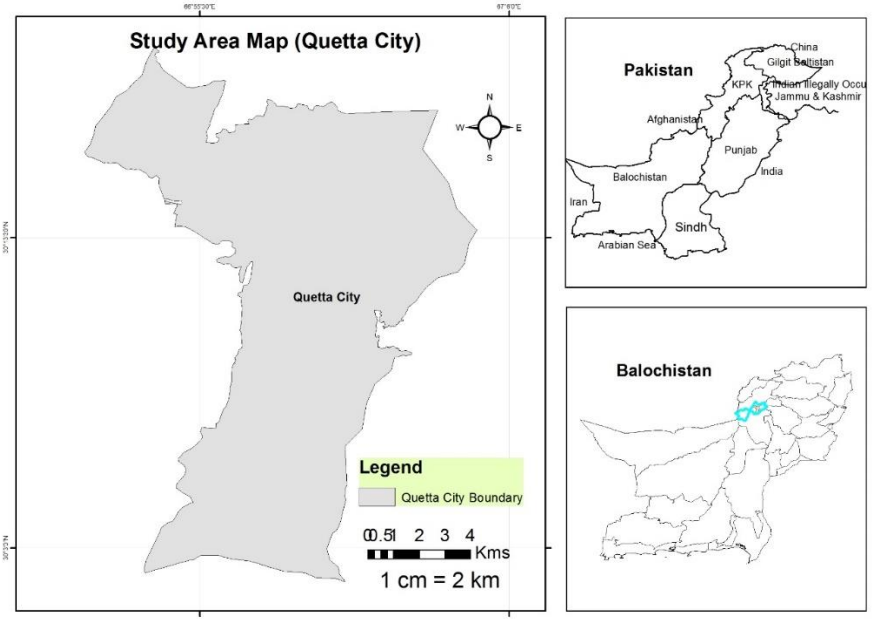

Fig.1: Study area

Cropping systems and water availability vary by zone. As altitude rises, rainfall rises with it, allowing upland farmers to cultivate high-value crops (Akhtar et al., 2021). Balochistan's climate ranges from semi-arid to hyper-arid, with significant evaporation rates and little, geographically dispersed rainfall (Kakar, Khair, Khan, & Khan, 2016). Wheat, maize, sorghum, barley, apples, apricots, grapes, and dried fruits are among the major crops

cultivated in Quetta and the neighboring areas. Quetta city is mainly dependent on irrigated agriculture (Burke, Huda, Hamza, & Azam, 2005).

2.2 Study design

This research is exploratory by nature which focused on water poverty situation in two different tehsils of district Quetta, namely Quetta city tehsil (QC) and Quetta Saddar tehsil (QS). The variables used in calculating water poverty index (WPI) were used to evaluate the water poverty status in the two selected tehsils (Sullivan, 2002). QC Tehsil had a population of 1,726,199 and with total recorded household to be 206,151and QS population was found to be 528,774 with 68,190 households (Pakistan Bureau of Statistics, 2017).

2.3 Sample size

Sample size was determined using the formula of proportionate sampling designed by Yamane, (1969) which is as follows:

$n = N/1+N(e)^2$

Where:

n = sample size N = total number of populations e = Margin of error (MoE), (e) = 0.05 according to research condition.

The population of QC Tehsil was 1726,199 and Household (HH) were 206,151 while QS Tehsil showed a population of 528,774 with 68,190 HH (Pakistan Bureau of Statistics, 2017).

Total HH A + B = 206,151+68,190 = 274,341

The total sample size according to formula is 400, while sample size for Quetta City Tehsil is 300 and for Saddar Tehsil is 100.

2.4 Data collection and sampling design

The water poverty situation was determined using both primary and secondary data (WPI). The primary data were collected via a questionnaire among the target population. Secondary data were gathered from Quetta's public sectors and related departments. A proportional sampling design was used for the sample respondents. For selection of a sample, the whole population was divided into sub-populations (strata), and random samples were selected from each stratum.

2.5 Statistical analysis

Statistical package for social sciences (SPSS) 22.0 was used for data processing and statistical analysis. For quantification of data, descriptive statistics were used. Further, chi-square analysis was used for the comparison of qualitative samples among the QC and QS tehsil. Independent sample T-test was used to compare means of quantitative data among the selected tehsils.

3. RESULTS AND DISCUSSION

Socio demographic characteristics of the respondents showed that mean age of respondents, average income and number of members in the family in QC were 28.76 years ± 10.26 years, 82951.67 PKR ± 109069 PKR and 9.41 ± 8, respectively. Saddar tehsil had shown the mean score of 40.37 years ± 14.28 years for age, 73820 PKR ± 71851 PKR for average income and 9.21 ± 6.21 for number of family members. Education status was found to be varying among the participants of selected tehsils with 20% illiteracy in QC and 22% in QS. QC showed a total of 57% respondents belonging to higher education institutes while QS only showed a total of 37% people having a higher education. 51% respondents from QC reported to be living in a joint family system and 49% reported to be living in a nuclear family system. On the other hand, most of the participants (70%) of QS tehsil reported to be living in joint family system. Most of the respondents in QC were employed either in government (18.33%) or private setups (16.33%) while people of QS were mostly dependent on personal business (24%), wage labour (22%) or government employment (18%). The interesting feature of occupation was the unemployment rate which was found to be quite high in QC (32.67%) as compared to QS (16%). Only 10.67% respondents from the QC had dependency on agriculture while 15% respondents from QS used agriculture as a source of income.

3.1 Water poverty situation

The collected data based on the variables of interest including water resources, access to water, use of water, capacity of the respondents and environment of water was analyzed to examine the water poverty status. These variable's results are shown below.

3.1.1 Water resources

Data on the available water resources showed that most of the respondents from QC were dependent on a piped water supply (47.67%) followed by community well (32.33%). Borewell (11%) and tanker water (9%) use was less in QC. Similar to the QC, most of the respondents of QS also reported to be using piped water supply (41%). A fair share was found between borewell (26%) and community well (28%) among QS respondents. The availability of sufficient water supply was reported in almost half of the population from both tehsils. No significant difference was shown regarding water resources of the two selected tehsils when compared through independent sampling t-test ($p > 0.05$) (Table 1).

3.1.2 Water access

Analysis of the water access data revealed that most of the respondents of QC (59.47%) had a water source located near their houses while 53% respondents of QS reported to have a water source near their house. The access to water sanitation facility was found to be present in 57.67% in QC and 54% in QS. The presence of a vehicle for fetching water was reported by 38% of respondents in QC and 27% of the respondents in QS and showed significant difference when compared through independent sample t-test ($p < 0.05$) (Table 1). While a major proportion from the overall population had no access to vehicle for fetching water from the filtration plant.

3.1.3 Water use

The use of water varied greatly among the participants of two tehsils. More than half (52.3%) of the respondents from QC reported to have been using portable water for drinking purposes while only 23% of respondents from QS showed to be taking portable water for drinking. This significant difference was statistically tested by using independent sample t-test ($p < 0.01$) (Table 1). A greater proportion (77%) of study population of QS was hanging on to tap water for drinking purposes. Taker water use as a replacement for piped water supply was reported in a great majority of the study respondents. 86% respondents from QC and 96% respondents from QS reported to have been using tanker water in case of a deficient water supply from piped water. The use of water from available resources for agricultural production was found to be present in 43.3% study population in QC and 19% in QS tehsil.

3.1.4 Capacity of the participants

The livelihood capacity of the participants was assessed in order to determine its impact on water poverty situations of the individuals. Study

respondents provided details on their family members with serious illness which was found to be present up to some extent in the family members of both tehsils. A total of 31.67% respondents from QC and 24% from QS reported to have family members with serious illness. The interest of people of both of these tehsils was lower towards a membership with a water association. Among the study population, only 14.67% in QC and 3% in QS reported to have a member registered with a water association. Employment of the family members both in public and private sector was found to be 2.22 member's ± 1.74 members in QC and 1.91 members ± 1.27 members in QS. The employment status did not show any significant difference when independent sample t-test was applied ($p > 0.05$). Mean income per month was reported as 33758 PKR ± 25516 PKR by the respondents of QC while 21342 PKR ± 22664 PKR was found to be the average monthly income of QS participants. The t-test for monthly income also showed significant difference between the two tehsils ($p < 0.01$). QC tehsil had a higher ratio of people making it to secondary education with a mean of 4.55 ± 3.51 while QS had 3.41 ± 2.04 members per family making it to higher education as per data provided by the study respondents. Educational achievement of the two tehsils also showed significant difference through t-test ($p < 0.01$) (Table 2).

3.1.5 Water environment

Water environment of both of the tehsils QC and QS was also examined. Data on the water environment showed that a clear water supply was available to 45.33% of the respondents residing in QC and 75% respondents residing in QS. The t-test showed significant difference for water environment of the two tehsils ($p < 0.01$) (Table 1).

3.2. Secondary data on the presence of water poverty in QC and QS

Available data present at water and sewerage authority (WASA) and irrigation department was also used for the identification of water poverty status in QC and QS tehsil of district Quetta. Secondary data on the water resources showed that, QC had a better sanitation and sufficient water supply available as compared to QS (Table). A total of 60% respondents had an adequate distance to the water availability source and 30% had the facility of transportation for fetching water in QC which was also better than 30% and 10% population access for said factors in QS, respectively. Only a little number of people (15%) used filtered water in QC and a good proportion (40%) had access to water tankers which were better figures than those of the ones found in QS (Table). Based on the participants' capacity data, QC tehsil was far better than QS with half of the population

being economically active, a greater proportion (80%) of people living above poverty line and close to half of the population (40%) being employed. Number of children aging above 10 years were more in QS than QC tehsil. Though most of this data was in favor of QC, the most important thing was the contaminated water supply which was found to present in a high percentage (70%) in QC while only a little number of people (20%) had contaminated water for their use in QS (Table 3).

Table 1: Descriptive data of WPI

Variable	Factor	Category	City Tehsil		Saddar Tehsil		P value
			ƒ	%	ƒ	%	
Resources	What is the main source of water?	Borewell (Personal)	33	11	26	26	< 0.01
		Household water supply (Piped)	143	47.67	41	41	
		Community well	97	32.33	28	28	
		Tanker water	27	9	5	5	
	Sufficient water supply for daily use	-	157	52.33	48	48	>0.05
Access	Water source located near house	-	179	59.67	53	53	<0.05
	Availability of proper sanitation facility	-	173	57.67	54	54	<0.05
	Vehicle to fetch water from filtration plant	-	114	38	27	27	>0.05
Use	The use of portable water for drinking	-	157	52.3	23	23	< 0.01
	Use of tanker water in case piped supply in unavailable	-	258	86	96	96	< 0.01
	Use of available water for agriculture	-	130	43.33	19	19	< 0.01
Capacity of the participants	Family members with serious illness	-	95	31.67	24	24	>0.05
	Member of association related to water use	-	44	14.67	3	3	<0.01
Water environment	Contaminated water supply	-	136	45.33	25	25	< 0.01

Table 2: Quantitative data of QC and QS tehsil

Variable	Factor	City Tehsil	Saddar Tehsil	P value
		Mean	Mean	
Capacity of the participants	Family members employed	2.22 ± 1.74	1.91 ± 1.27	0.168^{NS}
	Income per month	33758 ± 25516	21342 ± 22664	0.00**
	Family member	4.55 ± 3.51	3.41 ± 2.04	0.003**

	education up to secondary level			

Table 3: Secondary data collected from WASA department

Variable	Factor	City Tehsil	Saddar Tehsil
		%	%
Resource	Households with proper sanitation facility	20	10
	Households with sufficient water supply	30	10
Access	Households with water availability in adequate distance	60	30
	Transport facility to fetch water	30	10
Use	HH with potable water consumption (filtration plant etc.)	15	5
	HH who use tanker water	40	25
	HH who use water for gardening/agriculture	10	70
Capacity	Economically active population	50	20
	HH with income above poverty line	80	50
	HH with age above 10 years	10	20
	HH with employment	40	20
	HH membership with any water association	10	3
	Serious illness or disability due to contaminated water	15	5
Environment	Percentage of HH with contaminated water supply	70	20

4. DISCUSSION

Our study showed that most of the households of QC and QS tehsils of district Quetta were dependent on piped water supply along with community well and borewell being used by a fair number of people. 9% respondents of QC reported to be using tanker water which showed the either the absence to water source or the shortage of water in the area. Mahar and Attia (2018) found tube well to be used amongst 72% of the population residing in QC. The use of tanker water was also found to be present in his study which indicates the issue of water shortage in some areas of QC. Only half of the study population from both tehsils was satisfied with the presence of ample water available for use. Though the

presence of piped water supply is reported to be in greater amount, only 43.5% of the respondents of QC reported to have a clean water supply. A similar finding was found with in the secondary data recorded from WASA irrigation department which showed a 70% presence of contaminated water supply in the QC while only 20% households of QS reporting to have a contaminated supply. Leakage and contamination in the distribution system, as well as inappropriate storage, may be to blame for the contaminated piped-water supply (Chalchisa, Megersa, & Beyene, 2018). Further, 86% respondents of QC and 96% respondents of QS reported to be using tanker water in replacement of piped water supply when either it was less or contaminated. However, if water storage tanks are not handled hygienically, for as by using clean utensils and closing or covering the tanks, they have an influence on water quality. The loss of disinfection residual, bacteria regrowth, inadequate turnover, and prolonged detention time are all common issues in storage tanks and reservoirs (Constantine, Massoud, Alameddine, & El-Fadel, 2017). 52.3% of the respondents of QC reported to be using portable water for drinking while only 23% people of QS took portable water for drinking. The remaining respondents from both tehsils were greatly dependent on the available tap water either from piped supply or from water tankers for fulfilling their water drinking needs. In an earlier study, Butt and Khair (2016) found great prevalence of water borne diseases due to consumption of contaminated tap water in Quetta. 75% population from the study was affected by water borne illnesses including diarrhea, typhoid, cholera etc. A total of 59.47% respondents of QC and 53% respondents from QS had a water source located near their homes. Shah, Singh, and Mukherji (2006) found that slums and informal settlements in and around big cities, such as Dhaka, Mumbai, and Hyderabad in India, and Karachi, Lahore, Faisalabad, and Quetta in Pakistan, were particularly vulnerable to water insecurity. This been said, more than 40% population in both QC and QS had a water source situated at some distance with insufficient supply being reported in around half of the overall study population. The findings Mahar and Attia (2018) suggested a poor sanitation system in Quetta which was also found in our study with more than 40% population reporting to have insufficient water sanitation facility in both QC and QS. QC tehsil possessed a greater percentage (31.67%) of people having a family member with serious illness as compared to QS tehsil (24%). Apart from that, QC was found to better in terms of education with 4.55 ± 3.51 persons of a family making it to higher education and average monthly income with a mean income of 33758 PKR ± 25516 PKR. QC participants also had a better tendency in membership with a water association with 14.67% respondents having a registration as compared to only 3% respondents of QS. People of QC were mostly dependent on jobs for their survival while QS possessed a greater

proportion of businessmen (Table 1). The livelihood capacity defines the ability of a person to avoid poverty which itself contributes to the purchasing power of individuals (Deaton & Dupriez, 2011). Though, QC showed better livelihood assets as compared to QS, still, water was either poorly available or poorly treated which contributed to water poverty in both of these tehsils.

5. CONCLUSION

This study evaluated the water poverty situation using WPI in city and saddar tehsil of Quetta district. Though, the livelihood capacity and education level were found to better in QC yet contaminated water supply was found to be present in a higher proportion in QC tehsil as compared to QS tehsil. Apart from this, the use of tanker water was also eminent in the respondents of both the tehsils, which can be subjected to contamination and microbes. Thus, the quality of tanker water can be greatly affected and it can cause certain health hazards. The lack of proper sanitation, shortage of water supply and limited access to financial resources played their part in further worsening of the conditions. Looking into these conditions, targeted approaches are required to eradicate or reduce the water poverty in said tehsils. Nimble policy makings can not only help people to have ample access to safe water but also raise their standards of living and eradicate the contributing factors of water poverty.

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