

# Water Carriage by Women in Hilly Areas of North-East India: Challenges and Future Research Direction



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**Abstract** Statistics show that in India, 20% of the rural areas are still devoid of essential quantity and quality of water. Daily water carriage by women folk for drinking and household activities is common in rural India. Traditional methods of carrying water on the head, shoulder, and waist or by hand are tiring and impacted by numerous factors like weather conditions, distance, walking path, etc. Such activities lead to adverse health consequences like musculoskeletal disorders (MSDs) in the long run. Water carriage by women in hilly areas of North-East India is challenging from multiple perspectives. The prevailing practice of on-head carrying of water is a risky and time-consuming task. The risk and drudgery are enhanced due to slippery, uneven, hilly terrain, no support structure/mechanism for climbing up-down, bad weather conditions, and long-distance travel. The people, especially the women in hilly rural areas, face tremendous hardship to carry water, but there is a lack of reported research and thereby, appropriate intervention to resolve the issue. Following the literature review, it is evident that various attempts have been made to supply drinking water in hilly areas. However, many of these interventions are not feasible/influential due to prevailing climate conditions. There is a need to strengthen such traditional practices through appropriate context-specific design interventions. Hence, it aims to document the current scenario and various challenges faced by the women of North-Eastern hilly areas to develop a proposal for the most feasible interventions.

**Keywords** Ergonomics · Anthropometry · Backpack · Mode of water carriage · Problems of carrying water · Water problems in NE Region · Women carrying water

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## 1 Introduction

In rural areas of most developing countries, the sole responsibility of collecting water for their family falls under women, girls, and children. Women also spend more time gathering water than men. It is also common in developing countries for women to face health problems while collecting water [1].

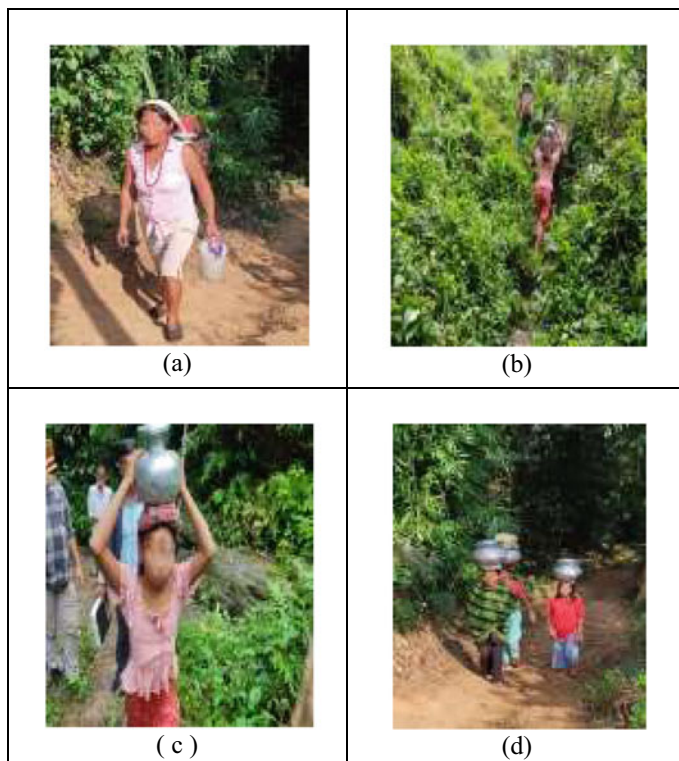
In the existing scenario, carriage of water by people is done in various ways. Water-filled containers are carried on the head, shoulder, waist, or by hand by the women folk for drinking and household activities is the most common practice (Fig. 1). However, carriage of water with wheelbarrows, animal-drawn carts, or rolling water-filled containers are prevailing practices in rural areas. In some hilly areas, a water supply system is done using a pressure control tank. Water is carried through the supply pipe according to the difference in latitude from a water storage structure into a pressure control tank and stored temporarily. Water supply is done by discharging downward [2]. As per data, 150 Million Woman Days and INR10 Billion are lost every year in fetching water globally [3]. Report by The United Nations indicates that more than 2 billion people around the globe lack safe and clean water. In another study among 25 countries in sub-Saharan Africa, United Nations Children Fund revealed that about 16 million hours are spent by women fetching water every day [4]. A study in Kenya shows that an average of 4.5 h per week is spent collecting water for a home. This activity brings 77% worry about their safety and 24% from looking after their children. As per the report, in Asia and Africa, the average distance traveled for collecting water by women is 3.7 miles (6 km) every day [5]. Carriage of such loads on foot over the uneven, slippery road and steep terrain can bring about health issues such as strained backs, necks, heads, shoulders, and other injuries [6].

Data shows that in India, 20% of the rural population still lacks the necessary quality and quantity of water for their homes [7] and it is also projected India will face severe climate-induced stress due to water. In the hilly areas, the habits, and lifestyles of people are closely associated with nature. It influences to a large extent the development of the human being. Although scientific knowledge related to climate change and water-the most essential commodity is growing at both global and national levels, necessary knowledge on the human dimensions of the same at local levels is weak [8].

In a World Water Development Report, India ranks 120 out of 122 countries and ranks 133 out in a list of 180 countries for quality of water. Whereas other countries nearer to India like Bangladesh, Sri Lanka, Nepal, and Pakistan have a better position than India having 40th, 64th, 78th, and 80th positions respectively [9].

Let us have a glance at the census report of India, 2011. Report shows that NE region has a total population of 455,87,982 numbers. It reflects that the Region has 4% of the total population and 8% of total landmass of India [10].

From the data mentioned below, we can have an idea about the sources of drinking water available in NE India (Tables 1 and 2).



**Fig. 1** Different modes of carrying water by women in hilly rural areas

**Table 1** States of North-East India with the population (*Source* [10])

Name of state	Area (SqKM)	Population as per census (2011)	Population density (/sqm) (2011)	Rural house hold (%)	Urban house hold (%)
Assam	78,438.00	3,11,69,272	397	84.80%	15.60%
Arunachal Pradesh	83,743.00	13,82,611	17	74.80%	25.20%
Tripura	10,491.00	36,71,032	350	72.10%	27.90%
Manipur	22,347.00	27,21,756	122	66.20%	23.80%
Mizoram	21,081.00	10,91,041	52	47.40%	52.60%
Meghalaya	22,429.00	29,64,007	132	78.40%	21.60%
Sikkim	7,096.00	6,07,688	86	72.10%	27.90%
Nagaland	16,579.00	19,80,602	119	71.20%	28.80%

**Table 2** Data obtained in Dima Hasau district, Assam and Khowai district, Tripura

Sl. no	Parameters	Range	Data obtained (nos.)	Data obtained (%)
1	Age (years)	Upto 20	23	18
		21–30	14	11
		31–40	53	42
		41–50	23	18
		Above 51	13	10
2	Height (cm)	Upto 140	5	4
		141–150	83	66
		151–160	38	30
		161–170	0	0
3	Weight (kg)	Upto 40	23	18
		41–50	78	62
		Above 50	25	20
4	Mode of carriage	Backpack	4	3.2
		Hand carriage	63	50
		Head	119	94
		Other	0	0
5	Type of carriage container	Plastic container	89	71
		Drum/Tin	30	24
		Bottle	119	94
		Other	52	41
6	Cost of existing container (INR)	Upto 100	1	0.8
		101–500	89	71
		501–1000	35	28
		No comm value	1	0.8
7	Carriage done by people	Male	0	0
		Female	126	100
		Child	0	0
8	Source of water	River	0	0
		Lake/ditch	23	18
		Foothills	75	60
		Deep well	28	22
9	Distance to be traveled (km)	0–1	77	61
		2–3	48	38
		>3	0	0
10	Road condition	Katcha	126	100
		Pucca	0	0

(continued)

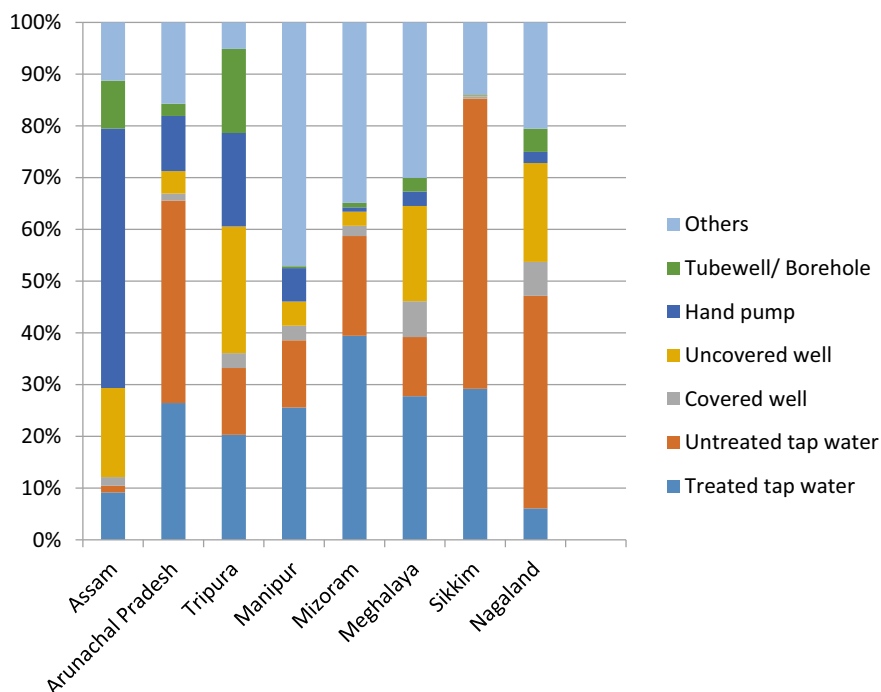
**Table 2** (continued)

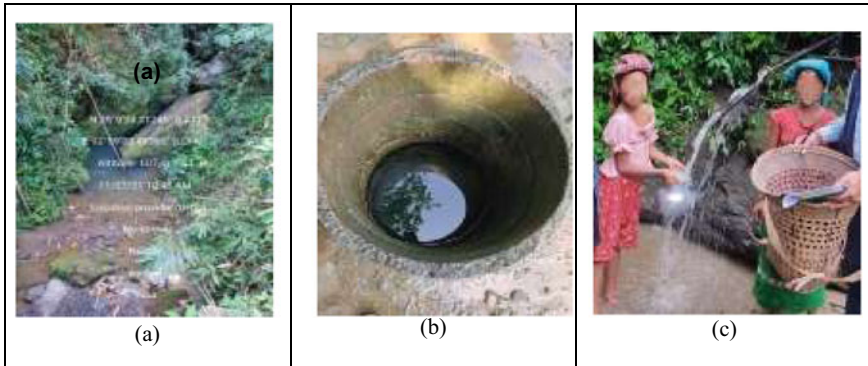
Sl. no	Parameters	Range	Data obtained (nos.)	Data obtained (%)
		Sand gravel	0	0
11	Qty of water carried (L)	1–10	12	10
		11–20	114	90
		>20	0	0
12	Family members (nos.)	1–4	19	15
		5–7	95	75
		>8	12	9.5
13	Av. Requirement of water (L)	1–20	0	0
		21–50	0	0
		51–100	52	41
		>100	74	59
14	Av. Climatic condition	Hot	0	0
		Cold	126	100
		Moderate	0	0
		Others	0	0
15	Water to be carried (month/year)	1–3	0	0
		4–6	0	0
		7–9	46	37
		10–12	69	55
16	Source of income	Cultivation	113	90
		Service	0	0
		Business	23	18
		Others/laborer	25	20
17	Av. Income/month/family ( $\times$ 1000) (INR)	1–5	30	24
		6–10	85	67
		11–20	11	8.7
		21–30	0	0
		20	0	0
18	Max. cost they can bear (INR)	Nil	10	7.9
		1–500	74	59
		501–1000	42	33
		1001–2000	0	0
		>2000	0	0
19	Troubleshooting	Head, neck pain	124	98.4
		Back pain	107	85
		Body pain	108	86

(continued)

**Table 2** (continued)

Sl. no	Parameters	Range	Data obtained (nos.)	Data obtained (%)
20	Quality of water (visual)	Others	27	21
		Clean	93	74
		Dirty	12	9.5
		Contaminated	93	74
		Others	0	0
21	Purification measures taken, if any	Filter	12	9.5
		Boiling	0	0
		Others	0	0
		No measure	114	90
22	Expectation	Alt. measure helpful	56	44
		Needed FoC through Govt	50	39.68
		No comment	29	23

**Fig. 2** Distribution of drink water sources in states of NE India (Source [10])



**Fig. 3** Some of the existing sources of water in hilly rural areas of the NE Region

In our country, only 4% of households use other sources of water like lakes/ponds, springs, rivers/canals, etc. than water from the tap, well, and tube well/ borehole. 15% of people in the region use the same water.

Figure 2 shows different sources of water available in their locality.

It is clear from the figure above that the majority of people in Arunachal Pradesh, Nagaland, and Sikkim use tubewell or boreholes as sources of water, while in Assam majority of people use tape water followed by uncovered wells, other sources, and hand pumps. In Manipur, Mizoram, Tripura, and Meghalaya majority of people use other sources, tape water uncovered wells, and tap water respectively (Fig. 3).

The most risky factor for the people in developing countries is the lack of safe water. It has been extensively reviewed to enhance access to safe water and reduce the impact on health. At the same time, the focus on acute infectious illness related to water is also reviewed for evaluation of the outcome.

### **1.1 Problem Statement**

Traditional methods of carrying water bring health issues to the carrier. It shows that regular carriage of loads of water results in adverse physical stress for women. Such a load without physical ergonomics is harmful to the carrier's health. It may lead to musculoskeletal, spinal, or other joint-related disorders. Carrying water physically by such means as on the head, shoulder, or hand with various types of porters results in various types of health injuries related to catastrophic, spinal problems Et cetera. It may lead to even the end of life too. It results in dysfunction in the neck, in particular, occurs in women with chronic pain [11].

Carrying loads of water is an enormous physical hardship for the children. Their learning in school is also severely affected by this kind of regular activity. If water is scarce, usage of water for preparing food, drinking, Et cetera is always given priority. Other tasks at home are assumed to be of second priority. Rural women

are capable of undertaking household laundry at some intervals. Bathing for them at home may also be done at some intervals. Limitations of this kind hamper the good health of the people since it may lead to skin-related problems, which is typical for them. Soon after the dry season, the availability of water in the distinct sources gradually vanishes. During that time, women and children had to face a tough time collecting water. They have to travel further in search of other sources of water at long distances. This kind of tough job of carrying water physically is a risky factor. Even if water is collected by some means, water quality becomes a secondary factor and a notable concern [12]. The quality and quantity of both surface and ground-water are constantly changing due to environmental degradation and anthropogenic activities. These changes in the properties of water contribute to water pollution. Water quality depends upon the physical–chemical and biological characteristics of its surrounding environment. Contamination in drinking water may give rise to serious health hazards. It may also result in various water borne diseases like typhoid, cholera, jaundice, dengue, scabies, botulism etcetera [13].

The people, especially the women in hilly rural areas, face tremendous hardship in carrying water [14], but there is a lack of reported research and thereby, appropriate intervention to resolve the issue. Following the literature review, it is evident that various attempts have been made to supply drinking water in hilly areas. However, many of these interventions are not feasible/influential due to prevailing climate conditions and frequent land-slides [15]. Such a type of practice of carrying water is a time-consuming task and a risky factor for the carrier. On the other hand, precious time for women is lost to a large extent. It stands as an obstacle to the growth of the economy of the family too.

## ***1.2 Aim***

Water carriage by women in hilly areas of the North-East India: Challenges and future research direction and how to address the challenges.

## **2 Methodology**

This correlational study included a total of 126 nos. of females and girls who carried water in some parts of hilly areas of the North-East Region. Each respondent voluntarily signed an informed consent form after the overview of the research was thoroughly explained to them.



## **2.1 Survey Planning**

Following the literature review, the questionnaire was designed. Based on the designed questionnaire, primary data were obtained one by one by direct interaction with the people carrying water living in those hilly areas of NER. Sources of water, prevailing means/ways of carrying water, condition of the roads carrying water, weather conditions, and distance to be traveled from the source of water to their respective destinations/homes were physically observed. Physical data such as gender, age, height, weight, height from waist to shoulder, etc. of the interacted people were recorded. Photographic and video graphic evidence of the activities were also taken.

### **2.1.1 Location**

The study was carried out for 61 nos. of people at Langting, Durringpunchi C.D., and Hafflong under Dima Hasaou district, Assam. The same study was also carried out for 65 nos. of people at Nonachora, Hajpara, and Waisokpara under the Khowai district of Tripura.

### **2.1.2 Targetted Users and Respondents**

People carrying water for drinking and household use in hilly areas of the North-East Region were targeted. The study was carried out on a total of 126 nos. of people. Out of those people, 100% people were found to be female (108 nos. of women and 18 nos. of girls).

### **2.1.3 Questionnaire Development**

Following the literature review, a detailed questionnaire relevant to the process of water carriage, its difficulties, road conditions, physical parameters of people carrying water, environment conditions, distance to travel to carry water, socio-economic condition of people, impact on health on water carriage, etc. was prepared for obtaining data from the people carrying water in hilly areas of the North-East Region.

### **2.1.4 Data Collection**

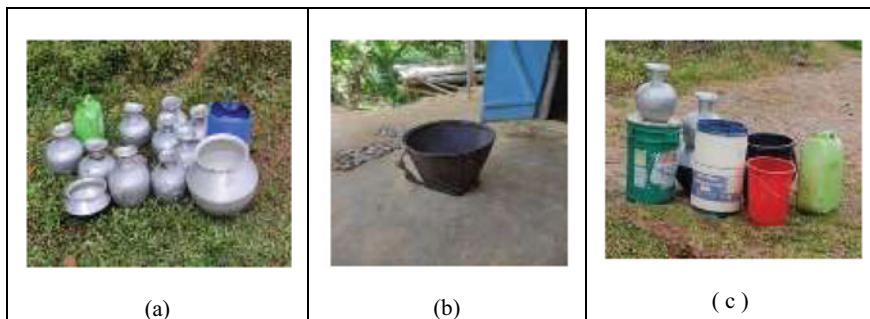
Field data were obtained from 61 nos. of people at Langting, Durringpunchi C.D., and Hafflong under Dima Hasaou district, Assam. The same was also obtained for 65 nos. of people at Nonachora, Hajpara, and Waisokpara under the Khowai district

of Tripura. Primary/open-ended data were obtained based on the prepared questionnaire by direct interaction with the people carrying water in those places. Details of prevailing practices of carrying water right from the collection of water at the source to the storage of water were observed. During the process of carrying water, they were stopped and interaction was done one by one. Physical measurement of people such as age, height, weight, etc., gender of people carrying water, environment condition, distance to travel to carry water, socio-economic condition of people, impact on health on water carriage, etc., Sources of water, prevailing practices of carrying water, amount of load carried by them, condition of the road, mode of carriage, distance to travel, etc. were recorded. Pictorial evidence & videography of the activities were also taken.

### 3 Results and Observation

Prevailing traditional methods of carrying water by the women were observed. The main issues, challenges, and various problems faced by them were discussed thoroughly. So many people responded well, and expressed their will & woes, expectations, and the issues which may be summarized as follows:

- (a) The responsibility of managing water for their household use comes under the women.
- (b) Women belonging to the places like Langting, Pitilikei, Durringpunchi, etc. under the Dima Hasao district of Assam use *Longkhai*- a locally bamboo-made pan wherein they put containers, plastic bottles, etc. filled with water and carry it on their heads. The main sources of water are deep well, foothills and streams. People (mainly women) from Nonachora, Hajpara, and Waisokpara under the Khowai district of Agartala use *Langa*- a locally bamboo-made container wherein they put the water-filled plastic, and silver containers and carry water on their heads (Fig. 4).
- (c) People living in those areas are very poor. Most of the habitats are cultivators (90%) by profession.



**Fig. 4** Figures showing some containers used to carry water in hilly areas of NE Region

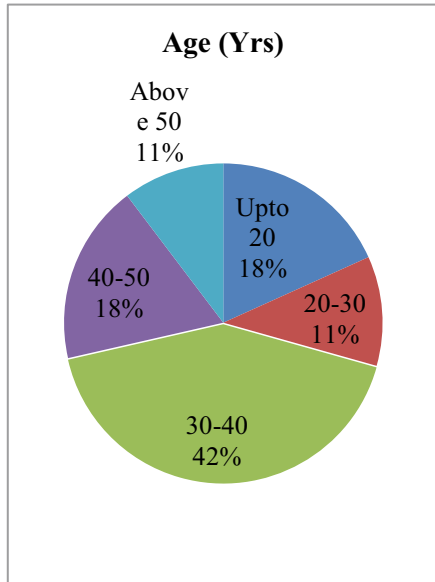
- (d) There is always a scarcity of necessary water for their use. Public water supply facility in those areas is still not done.
- (e) Road communication from the sources of water to their home is hilly and uneven, and Katcha road. They carry water on their heads with high risk. Roads become slippery during rain and become very dangerous to walk on.
- (f) Most people need to carry water throughout the year.
- (g) Physical stress due to the carriage of load leads to pain in the head, neck, waist, and even the whole body of the carrier. As a result of pain, they suffer from fever also.
- (h) Some of them have to travel up to 2 km also to carry water. Continuous carriage of load for so long distances gives rise to pain in the leg too.
- (i) Lots of valuable time is wasted in carrying water. Mothers can't look after their children well due to business in carrying water for all the members of their family.

Data obtained from the survey of 126 nos. of respondents may be tabulated as follows:

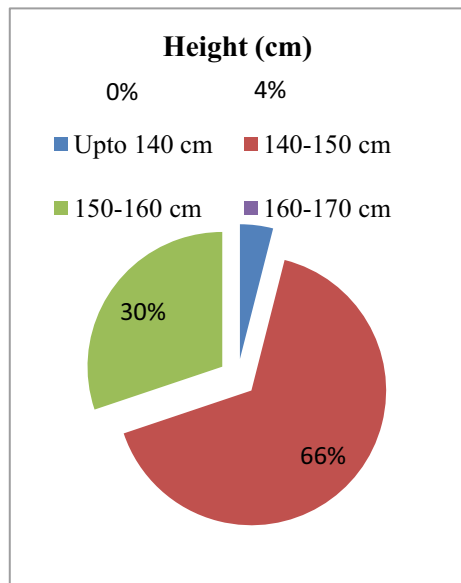
From the above data, the following observations can be made:

- (a) It was observed that out of the 126 people carrying water, 100% were female (Women-108 nos., girls-18 Nos.).
- (b) The socio-economic condition of the people is very poor. Most of the habitats are dependent upon cultivation only (90%).
- (c) Family size of most households (75%) is 5–7 members.
- (d) Monthly income of most families (67%) falls in the range of 5–10 thousand rupees only.
- (e) The majority of females carrying water were in the age group of 30–40 years (Fig. 5).
- (f) Max. nos. of females (66%) carrying water fell under the height range of 140–150 cm (Fig. 6).
- (g) Weight of max. no. of females (62%) came in the range of 40–50 kg.
- (h) 94% of females carried water on their heads and 54% of females carried water on their hand only. 44% of females carried both hand load & head load.
- (i) The main source of water was foothills (66%) and a little deep well (22%).
- (j) The majority of females carried water from the 10–20 L range excluding the weight of the container.
- (k) 55% of people have to carry for 10–12 months/year and 37% of people have to carry water for drinking & household use for 7–9 months/year.
- (l) 98.4% of people stated that their health is affected by head and neck pain, and 85% and 86% of people stated that carriage of water resulted in back and body pain respectively.
- (m) Water available in the sources was clean and contaminated (74%).
- (n) Almost no purification measure is taken by the people (90%).
- (o) 44% of people stated that the invention/ introduction of an alternate measure of carrying water would be helpful for them and around 40% of people stated that Government's initiation was needed for a better mode of carriage/supply of water.

**Fig. 5** Age-wise % of people carrying water



**Fig. 6** Height-wise % of people carrying water



(p) 59% of people stated that they could bear expenses for the container to carry water up to 500 rupees and 33% of people stated they could bear 500–1000 rupees for the same.

- (q) 75% of the family have family members of 5–7 nos. Accordingly, the daily requirement of water for most of the families (59%) is more than 100 L.

## 4 Discussion

To understand the current scenario of the people living in hilly rural areas of the NE Region, the study was conducted. During the study, basic demographic information, socioeconomic conditions, etc. were also collected. These data are very much relevant to understanding their present difficulties and at the same time planning for future research direction or to address the existing problems faced by them.

The result of the current study shows that the prevailing practice of on-head carrying of water in hilly rural areas is a risky and time-consuming task. The risk and drudgery of this task are enhanced due to slippery, uneven, hilly terrain, no support structure/mechanism for climbing up/down, prevailing bad weather conditions (rain, fog, low light, etc.), and traveling a long distance. Moreover, the loss of adequate time for their personal/household work is also a significant concern. Thus water carriage by women in hilly areas of North-East India is challenging from multiple perspectives [16].

Traditional methods of carrying water [17] on the head, shoulder, and waist or by hand are tiring and impacted by numerous factors like weather conditions, distance, walking path, etc. Such activities lead to adverse health consequences like musculoskeletal disorders (MSDs) in the long run [18]. Personal safety and comfort are always important during the execution of any work in any environment [19].

The present study also shows that road communication from the sources of water to their home is hilly, uneven, and Katcha road. They carry water on heads with high risk. Roads become slippery during rain and become very dangerous to walk on. Thus weather, topography, the poor economic condition of people, etc. are the key factors to face the challenges to carrying water by people in hilly rural areas of the North-East Region.

One of the major findings of the study is that carriage of water for long-distance in hilly terrain brings about health issues to the women carrying water. Due to prolonged carriage of heavy load on the head, they suffer from pain in the head, neck, back, and whole-body and which leads to fever in the carrier. Since women have other domestic responsibilities also, their families are badly affected. This is a very big challenge for the people carrying water in hilly areas by traditional prevailing methods.

Another important factor of the study is that although 90% of water is contaminated, the majority of people don't undergo any purification measures which is a health hazard for the people.

Finally, it can be conferred that despite so many challenges faced by the women carrying water in hilly rural areas of the NE Region, the initiative by the Government to improve the facility is not up to the mark.

## **4.1 Limitations**

The study was carried out in different hilly places in the NE Region. Primary data were obtained with direct interaction with the persons of those places. While undergoing the study, some of the limitations are stated below:

- (a) The survey was carried out in some specific hilly locations in NE India. It is not possible to do this in all hilly places of the NER due to geographical remoteness, poor road communication, etc.
- (b) Language is a major barrier to interacting with people of hilly rural areas of NER. They don't understand any other languages than their local language. In that case, assistance of mediators/translators was taken to obtain the data.
- (c) Most of the women and girls of the hilly rural areas feel shy to interact with a male from outside areas.
- (d) The knowledge & understanding levels of the women and girls living in those areas are very low. It is very difficult to get a reply directly to whatever is being asked for.
- (e) The sample size was small. So far as data from 126 nos. of people was obtained.
- (f) Only a few communities were involved in the collection of data. That is the sample size is very small.
- (g) Most of the people didn't want to speak anything of their will.
- (h) Some people thought that those type of questionnaire was not helpful and relevant to them.
- (i) Some of them did not want to comment anything directly on us.
- (j) The women carried water on their heads and hands only in those places. Any other modes of carriage of water were not seen.
- (k) Ages of the people carrying water were recorded on verbal information only.
- (l) Contamination of water carried by them was not tested and recorded on visual inspection only.
- (m) Distance from the water sources to their respective homes was recorded on verbal information only.
- (n) Monsoon or summer season is not favorable to visit those places due to hilly terrain, and uneven and slippery roads for collection of data.

## **4.2 Future Scope**

Looking at the problems, hardships, and challenges faced by the people, especially the women in hilly rural areas of the North-Eastern Region, it is perceptible that there is a scope of reported research and thereby, appropriate intervention to resolve the issue. Following the literature review, it is perceptible that various attempts have been made to supply drinking water in hilly areas. However, many of these interventions are not feasible/ influential due to prevailing climate conditions [20]. There is a need to strengthen such traditional practices through appropriate context-specific design

interventions. There is scope of developing some products which can reduce physical stress, and drudgery and thereby focus to improve the health condition of the women carrying water in hilly rural areas. Efficient modes of water carriage with adopted technologies will minimize the challenges faced them.

Improvement of road condition is also very important to minimize the existing problems faced by the women in hilly rural areas. Development of water supply facility, creation of water sources in nearest location of the habitats are also another focusing areas to reduce the current problems.

Hence, it aims to document the current scenario and various challenges faced by the women of the North-Eastern hilly areas to develop a proposal for the most feasible interventions.

## 5 Conclusion

Going through a participatory approach, a majority of people mentioned that they need better, safe, and convenient means of carrying water. Based on the proper document on the carriage of water in hilly areas of North-Eastern India there is the scope of inventing alternate modes of carriage considering the physical ergonomics of women living in those areas. Undergoing such activities, focusing on the women's good health shall be a significant factor.

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