KNOWLEDGE AND PRACTICE ON ARSENIC

A Study of Jahada VDC Ward No. 9, Nawalparasi District

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LETTER OF RECOMMENDATION

This is to certify that the thesis entitled ***"Knowledge and Practice on Arsenic, A Study of Jahada VDC-9, Nawalparasi District"*** has been completed by Keshab Dutta Paudel under my supervision for partial fulfillment of the requirements for Masters of Arts in Anthropology. I recommend this thesis for the final approval and acceptance by dissertation committee.

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LETTER OF ACCEPTANCE

This thesis entitled ***"Knowledge and Practice on Arsenic, A Study of Jahada VDC-9, Nawalparasi District"*** submitted to the Department of Sociology and Anthropology, Prithvi Narayan Campus, Pokhara by ***Keshab Dutta Paudel*** has been accepted as the partial fulfillment of the requirements for the Degree of Master of Arts in Anthropology by the undersigned members of the dissertation evaluation committee.

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ABSTRACT

Nawalparasi being of the hotspot of arsenic contamination and Jahada as one of its VDC has people whose health is susceptible to arsenic poisoning. Thus, the knowledge of arsenic is essential and its remedial application equally important. This research has been conducted among all houses of Jahada VDC Ward No. 9. Hundred households' records have been used for analysis. Respondents from each household gave information about their knowledge regarding arsenic, methods implemented to tackle with arsenic problem and the burning issues. The source of information is also recalled. The specific objective of this study is to investigate and analyze the impact of knowledge, perception and practice related to arsenic and to list out the factors that influence the arsenic removal procedures or techniques.

For achieving above mentioned aims, various tools and techniques have been applied. The research stands on the bases of both primary and secondary data despite preference to primary data as it is more reliable and authentic. Also informal discussion was conducted to collect the data. Quantitative data were collected through individual interview (semi structured), informal group discussion and interview. The universe of the study is the household of ward no.9 of Jahada VDC where all the hundred and eleven houses were visited but according to their residence and water sharing nature only hundred households or hundred tubewells were included. These households have different features like multi-ethnic, religion and language. Among those households a single person is selected as representative. Out of which female members, who were mostly housewives, were found higher than male. Majority of members were from Janajati group followed by hill Brahmins, Madhesis Dalits etc. Many (48%) of respondents were from 31-50 age group with majority of nuclear families (53%), and most having members 4-6 (58%). Status of literacy was average as most respondents expressed skill of only reading and writing, higher level of educational status was poor: only 4% were bachelor and above. The main source of income was agriculture (55%) for majority of households.

Almost all had shallow tubewell as source of drinking water (95%). Quality of drinking water was variable in majority (59%). Most (83%) knew about arsenic but extent of knowledge was variable. Majority 59% considered it as waster polluting agent. Most of the respondents (95%) knew about the methods of finding arsenic. Regarding the test, majority 75% have

tested water to find water contaminated with arsenic (90.5%) while 86% knew arsenic can be removed. Majority expected door step visit for arsenic testing (74%). Only half of the households (51%) had filter in working condition. Filter maintenance was done by female members (54.8%) in majority of households. There was no authentic record of arsenic test or filter maintenance.

People were not clear regarding arsenic matter. Knowledge of arsenic was limited only to arsenic as water polluting agent and arsenic filter as its remedial measure. They lack in-depth knowledge about symptoms and dreadful consequences of arsenic poisoning. Also knowledge of other remedial measures like balanced diet which can check the complexity of arsenic or bioremedial system i.e. using of special bacteria or plants to control arsenic were unknown to the people. They did not have proper knowledge on filter maintenance and replacement of damaged parts.

Practice on arsenic remedy was average. Most of them were unsuccessful in making optimum use of filter. They had developed a tradition of testing water for arsenic only when facilities were available at doorstep. There was neither tradition of regularity in testing water nor any updates of test records. They don't bother to get new filters or mend the damage part instead abandoned the filters when it stopped functioning.

Education played key role in affecting the acquiring of extent of knowledge and its perception. It equally affected practice of use of filter and its maintenance i.e. becoming more aware. Physical factors like accessibility of source of information of arsenic, arsenic test, availability of filter and its parts affected both knowledge and practice on arsenic removal. The complex technical terms and source of information in non native language became psychological factors affecting knowledge and practice of arsenic. It linked with memory and lack of interest due to tedious maintenance procedure. Hence Arsenic free water can only be obtained sustainably if the above mentioned factors are solved. This will help in protecting and promoting health of citizens. Thus a healthy society and nation with arsenic free water can be imagined.

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LIST OF ABBREVIATIONS

APHA	:	American Public Health Association
As (III)	:	Trivalent Arsenic
As (V)	:	Pentavalent Arsenic
As	:	Arsenic
CBS	:	Central Bureau of Statistics
DDC	:	District Development Committe
DoHS	:	Department of Health Services
DOL	:	Department Of Irrigation
DWQIP	:	Drinking Water Quality Improvement Program
DWSS	:	Department of Water Supply and Sewerage
ENPHO	:	Environment and Public Health Organization
ETPAM	:	Environment Technologies Programs for Arsenic Mitigation
FFF	:	Filters for Families
FINNIDA	:	Finnish International Development Agency
GDP	:	Gross Domestic Product
IARC	:	International Agency for Research on Cancer
IDWSS	:	International Decade of Water Supply and Sanitation
JRCS	:	Japanese Red Cross Society
KAF	:	Kanchan Arsenic Filter
LCBAN	:	Local Capacity Building for Arsenic Mitigation
MCL	:	Maximum Contamination Level
mg/l	:	milligram per liter
MIC	:	Minimum Inhibitory Concentration
MIT	:	Massachusetts Institute of Technology
MOAD	:	Ministry of Agriculture and Development
NASC	:	Nepal Arsenic Steering Committee
NIS	:	National Interim Standard
NRCS	:	Nepal Red Cross Society

ppb	:	parts per billion
ppm	:	parts per million
RWSSSP	:	Rural Water Supply and Sanitation Support Program
SCAD	:	Swarnim Academy for Community Development
SPSS	:	Statistical Package for Social Sciences
UNDP	:	United Nation Development Programme
UNICEF	:	United Nation Children's Fund
US-EPA	:	United State-Environment Protection Agency
VDC	:	Village Development Committee
WASH		Water And Sanitation for Health
WHO	:	World Health Organization
µg/L	:	Microgram per Liter

CHAPTER- I

INTRODUCTION

1.1 Background of Study

The land of Nepal is divided into Terai 23%, Hill 42%, and Mountain 35%. Nepal rises from 57 m (Jhapa's Massuriya) above sea level to 8848m (World's highest peak). Overall 53% of food crop is supplied by terai region. Agriculture provides employment opportunity to 66% of total national population while more than 81% of terai population is engaged in agriculture, despite the lack of necessary agriculture inputs and proper irrigation facilities agriculture contributes largest sector of economy i.e. 34.7% GDP. (Economic Survey, 2011/12, MOAD). Majority of Nepalese in agrarian society are illiterate following traditional techniques.

Terai area mostly depends on monsoon rain for cultivation while underground water is used for drinking and household purpose. The underground water is extracted through tubewell: namely pumps, shallow tubewell, well, deep tubewell etc. Tubewell water was not tested for arsenic for years and it was only 1990s that arsenic was discovered in high quantities. Arsenic occurs mostly in the shallow aquifers (approximately within 10-70 meters below earth's surface), which is where the vast majority of the drinking water tubewells tap into.(Paul & De 2000, Alam et al. 2002,WSP2002, Kinley & Hossain 2003)

Studies have shown that social and economic loss for people in arsenic areas are acute and rapidly worsening (Ahmed 2002; WHO 2000). Poorer households have been found to

India

India

India

have higher percentages of arsenicosis (disease related to arsenic) cases (Chakraborti et al. 2002; WHO 2009).

Above studies explains the use of tubewells, its necessity, and discovery of presence of arsenic. Arsenic (symbol As, atomic number 33 is a toxic metalloid (ATSDR 2007) which occurs naturally on earth in combined form in many minerals or mixed with other metals and sulphur. It is a semi metallic element which also occurs as pure elemental crystal. It makes 1.5 ppm of earth crust making 53rd most abundant element of earth. It is found in color metallic grey yellow or black. It enters the drinking water supplies from natural deposits in the earth or from agricultural and industrial practices. Arsenic can occur in water in inorganic form as oxyanions as trivalent arsenate As (+3) or pentavalent arsenate As(+5). Water containing arsenic remains colorless, odorless and tasteless like usual but becomes contaminated. Arsenic is a slow poison; which taken in low doses, it may be seven or eight years before the symptoms become apparent. The results of arsenic leading to arsenicosis may be severe. Arsenic causes thickening of skin, liver disease, digestive problem, shows linkage to cancer and diabetes. Also nervous system disorders such as tingling or losing sensation in limbs and hearing difficulties.

Nawaparasi, one of the 75 district of Nepal, situated in Lumbini zone of western development region of Nepal lies between 27º53'33"N Latitude and 83º6'66" Longitude. It is one of the districts of terai region which is highly affected by arsenic contamination. More than 50% of the tubewells of this region contain arsenic over the WHO guideline i.e. 10 ppb even studies found more than the Nepal's standard i.e. 50 ppb, as for example in 2011 arsenic levels in tubewells in Manahari (one VDC) of Nawalparasi on testing exposed 600ppb which is 60 times the limit of WHO deems safe to drink; Smith et. al. Nawalparasi not only has the highest number of tubewells with arsenic but also the arsenic concentration in tubewells is the highest in Nepal. This preliminary study is based on Jahada VDC of Nawalparasi District which is focused on the awareness about arsenic and its mitigation measures adopted by the people of Jahada VDC Ward No. 9.

1.2 Statement of the Problem

Arsenic is not merely a health problem, its severity curbs individual's socioeconomic status thereby ruin the family, community, nation and the world itself. Thus its consequences in long run are disastrous. It is true that information regarding arsenic and its consequences are disseminated to the arsenic prone areas directly or indirectly following the presence of

arsenic in Terai ground water since 2000 A.D. Despite it being a new term to water consumers: who had perceptions clear and clean filtered water is safe for drinking. Still today many studies and researches are in process regarding the intensity of arsenic present in water, its linkage with specific place and its permanent solution. The prime goal is to get rid of arsenic problem which on consumption will cause a disease called arsenicosis which usually occurs slowly often taking 2-20 years to manifest (UNICEF, 2013). The person may suffer severely with cancer or death ultimately.

Some of the conclusions from past studies are: awareness campaigns had the desired effect in terms of informing public which made them to change their behavior. Also the perceived negative consequences of taking a health action is most inflectional variable for predicting actions taken to avoid health risks. Results from studies showed that more knowledge of risks improved the perceived effectiveness of actions taken to avoid exposure. Further, it has been shown that perceived risk may decrease with increase in knowledge. (Aziz. et. al.2006)

Changes in knowledge, attitudes, and practices are vital: affected populations need to change the water source they use, but may resist change because of lack of understanding the danger from arsenic and because contaminated sources may be more convenient to use. Behavior change is thus a key potential asset for effective arsenic mitigation. (UNICEF 2013)

Nawalparasi being declared as the hotspot of arsenic has been a ground for different arsenic related studies. Various facts have been uncovered with potential remedies like use of arsenic filters like Biosand filter, SONO filter, Kanchan filter etc. These filters have certain principles of functioning hence required routinely maintenance and good care. But these filters were not used optimum instead some filters were used as planters or found dismantled in the yard, also the stand provided for filters had been converted to clothes drying rack. The villagers didn't understand the value of filter (Smith 2008).

There has been no micro level study regarding the knowledge level and practice of using filtered water till date. Studies carried out in Nepal generally concentrated on the conformity of arsenic presence and its magnitude. But with the invention of better technologies in neighboring countries have even confirmed the entrance of arsenic to our body through food, fruits, grains etc: (Sukerbuyk, 2012).

Thus the effect of arsenic on people's health is devastating. Even filters provided at subsidized rate are not getting proper care. In order to explore whether arsenic remedy campaign is taking place or not with this view the researcher aims to focus on:

i) What is the status of people's knowledge about arsenic?

ii) What is the situation of filter and how people have used it?

iii) If filters are not used, what could be the reasons of abandoning the filter?

iv) What are the views of people regarding arsenic problems?

1.3 Objectives of the Study

The general objective of the study is to analyze people's knowledge and practice on arsenic in Jahada VDC Ward No. 9. The specific objectives are:

1. To explore the knowledge of arsenic and diseases related to it.
2. To describe the different techniques and methods adopted by people to make water arsenic free.

1.4 Importance of Study

This study aims to provide knowledge about arsenic and its consequences so the people of Jahada VDC would become aware and make optimum use of means and facilities of arsenic remedy like use of filters. The main purpose is to find out the status of knowledge of arsenic and its remedial measures through various socio-economic aspects, psychological aspects that: why all people are not equally aware about arsenic contamination.

As poverty stricken household is more prone to ill health given an ongoing lack of resources for living and care. Low education levels and lack of knowledge further sustains the cycle, as the understanding of links between hygiene and water borne disease tends to come more easily to household with higher education levels. Moreover the uptake of behavioral changes such as enhanced sanitation and hygiene practices tends to take longer in poorer households. (Jalan and Ravallion, 2001)

The study is new regarding this subject thus is expected to enforce the understanding of arsenic and seek the remedial measures. It will help in clarifying effective solution of arsenic is possible with coordination of all sectors involved in water supply and public health, including government and Non-government organizations, local authorities, private sectors, international donors, experts in public health and communities themselves. This study will provide effective information for making practical programs successful related to arsenic mitigation. It also will be an essential tool for future researchers.

1.5 Limitation of Study

Since every study has its own limitation likewise this study is also vulnerable to various drawbacks and shortcomings because of varying constraints. It is only an academic study. The study area covers the information that past studies made on related topics and resides on the views and knowledge of the people and their honesty and hostility in interaction. This dissertation is an anthropological inquiry thus discussion and perception of illness and remedial measure may not be universal solution despite the information and data might be given to scientific studies. Lack of budget, time and the knowledge of researcher made the study constraint. Since the views and information collected from individual may not be the common for entire Nawalparasi or Terai region but researcher kept every effort to make the research more scientific and tried to meet the objectives as far as possible. The title of the subject being rare in the context of study, there are lots of difficulties some which are listed below:

1. Language problem: Due to its diverse ethnic group's common language as a means of communication for all members was lacking.
2. As no lab test or experiments were carried out thus the findings and conclusion may not be generalized exactly in the same manner to other places.

Despite the above mention facts this study will bridge the gap between policy makers, program implementers and future researchers about the people prone to arsenic problems.

1.6 Conceptual Framework

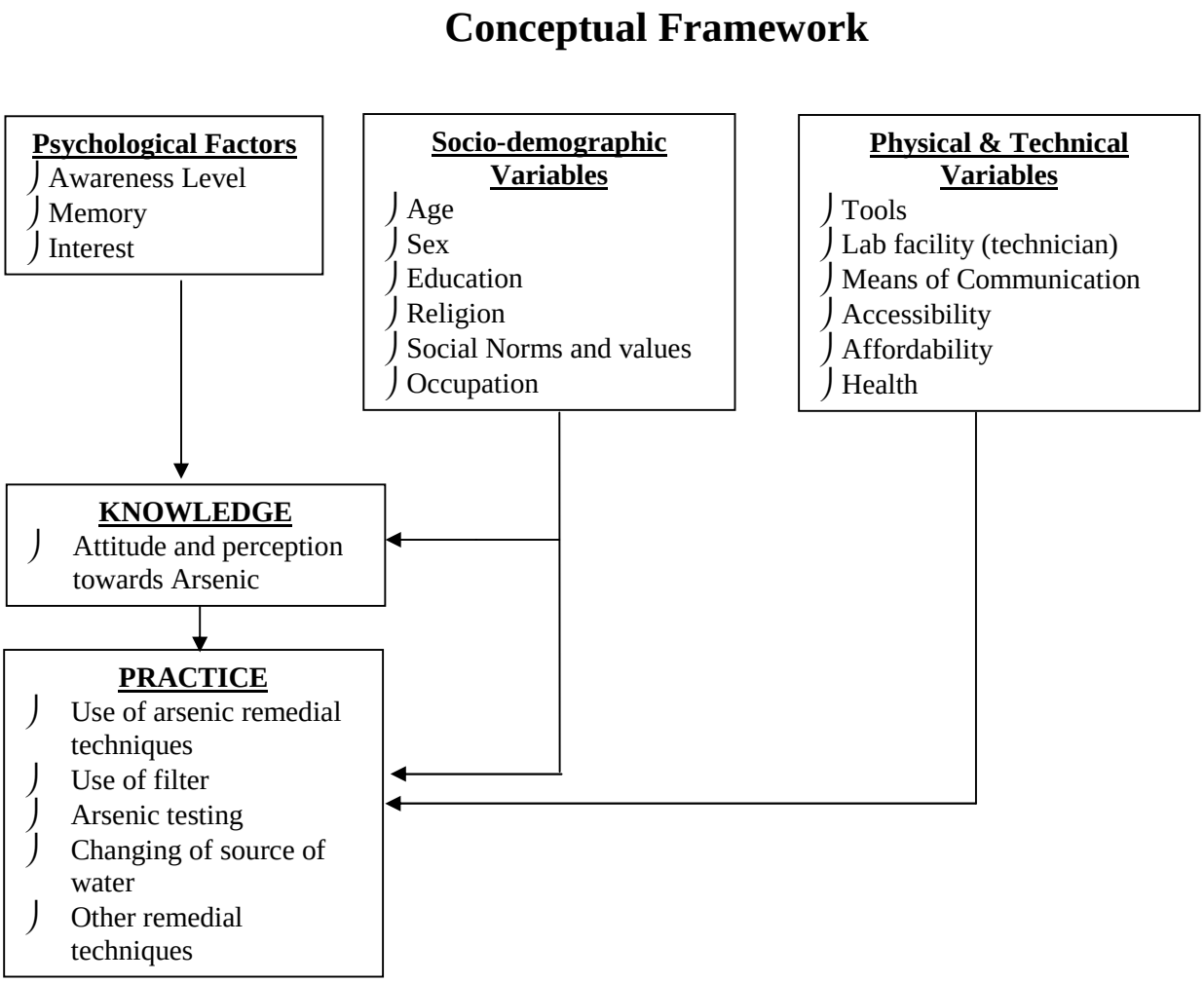

Figure 1.1 Conceptual Framework

The knowledge of arsenic can be obtained from various sources, directly or indirectly. The acquiring of knowledge will be influenced by psychological factors and socio-demographic factors as shown above. Simultaneously, socio-demographic variables can influence on practice of arsenic removal. Accordingly psychological factors play pivotal role in gaining and perception of the knowledge which one can implement to protect from arsenic. But the physical and technical variables as shown above are also important factors for removing arsenic.

1.7 Organization of the Study

This research has been divided into seven chapters as per nature of the study. It begins with introduction and ends with summary, conclusion and suggestions.

The first chapter includes the introduction, background, statement of the problems, objective of study, importance, limitations and conceptual framework of the study. The second chapter includes the overview of literature related to arsenic and its study. The third chapter deals with research methodology. The fourth chapter includes introduction of study of research area and socio-demographic data of respondents. The fifth chapter deals with the status of knowledge of arsenic. The sixth chapter includes the data and information regarding the practice of arsenic and its remedy.

Finally, the seventh chapter of this thesis ends with summary, conclusions and suggestions of the research. Other formats, pictures, questionnaires, scheduled etc. that were used for the study are attached after seventh chapter while list of abbreviation has been placed before the first chapter.

CHAPTER – II
LITERATURE REVIEW

This chapter deals with theoretical approach focusing on Medical Anthropology, its scope in human life along with the influencing factors. Previous studies about arsenic in different parts of the world and Nepal, its health effects and practice about arsenic removal filters have been reviewed.

2.1 Theoretical/Conceptual Overview

2.1.1 Medical Anthropology: An Introduction

The capability with which human being combining biological and cultural resources adapt to the environment is measured in terms of their health and disease prevalent. Anthropologists are interested about the existing inter-relationship between health and disease to the cultural, biological and environment factors.

The term “medical anthropology” is primarily an applied sub-discipline. The roots of the sub-discipline reach back to an intellectual, academic interests in describing and understanding the ways in which different non-western peoples have explained illness and given treatment to the sick. (Pelto and Pelto: 1990)

Medical anthropology is a bio- cultural discipline concerned with both the biological and the socio cultural aspects of human behavior and with the ways in which the two interact and have interacted throughout human history to influence health and disease it is the study of how social and environmental factors affect the health and awareness, alternative ways of understanding and treating disease (Foster and Anderson 1978)

Anthropologists who are concerned with medical anthropology actively engage in studying health and illness, have highly realized the biological, social and environmental factors need to be considered if human health is to be promoted or to reduce human suffering, for example some population have an appealing incidence of infant deaths due to diarrhea. The origin of this situation is mostly biological ingestions. But why are so many infants exposed to bacteria? Usually the main reason is social. The affected infants are likely to be poor. Because they are poor, they are likely to live with infected drinking water. Similarly, malnutrition may be the biological result of a diet, poor in protein, but such diet is usually also a cultural phenomenon, reflecting a society with classes of people with very unequal

access to the necessities of life. In many ways, therefore, medical anthropology and anthropology, in general are developing in the direction of a “bio cultural synthesis” (Ember and Carol et. al 200:503).

The Major areas of medical anthropology include ecology and epidemiology, ethno medicine, medical aspects of social system and medicine and cultural change. (Lieban, 1973)

2.1.2 Ecology and Epidemiology

Epidemiology has a close relationship to ecology. In the study of medical aspect of the adaptation and mal adaptation of human groups to their environment, cultural factors are of major importance. The ecological approach, characterized by comprehensive attention to the mutual relations between organisms and their environment, brings to medicine and public health a concern with multiple causes. It also focuses attention on multiple effects of human actions that alter the relationship between people and their environment, often with important medical consequences. This of course is a central contemporary issue in industrial societies, where various forms of environmental modification threats health. It also can be a permanent considering in assessing the net value of economic growth projects in depending societies. The construction of new irrigation systems in arid areas such as Egypt has augmented food production, but it also has increased the incidence of Schist osmosis, a disease carried by water borne fluke (Lieban 1973:16).

Brown and Inhorn (1990) has summarized the major themes on the study of disease and human behavior from an ecological perspective as follows.

- Disease occurs within ecological setting and thus is context dependent.
- Cultural practices can directly alter ecological relationship between interacting agents this has an immense influence on the human health.
- Evolutionary theories suggest that biological and cultural traits with adaptive value against disease are generally being selected for and maintained in a population as they enhance reproductive fitness.
- Human behavior, especially in the infectious diseases, plays significant role in its etiology.

2.1.3 Social and Cultural Aspects of Epidemiology

Epidemiology is both descriptive and analytic and the field has become increasingly concerned with the origin and cause of disease rather than with its distribution alone. Social

and cultural factors then may help determine disease etiology and distribution through their influence on the relationship between a human population and its natural environment, or through their direct influence on the health of the population. Social and cultural distinctions associated with differences in age, sex, occupation, class, ethnicity, and community can have significant effects on epidemiological phenomenon.

2.1.4 Ethno-medicine

Ethno-medicine is one of the major sub fields of medical anthropology. This is one of the most salient approaches taken by anthropologists in their analysis of illness healing and those of whom provide assistance when sickness strikes.

As mentioned above the ecological approach indeed is the soul of this study. Since the settlement of mankind or lost of mobility made them to till the nearby land growing crops and develop culture. The presence of water made them reside temporarily or permanently and the culture was the outcome of fusion of physical, biological, and environmental aspect. With the increase of population and demand of necessity, people made a choice to settle in plain areas too. In context of terai region the settlement started long after rise of migration pushing back the threat of malaria which had been obstacle to the population thus it was their culture which made a harmonious relationship with the environment with proper tuning with the available resources overcoming even deadly malaria. Through this research it is also an overview how the culture can be transformed so a very healthy sustainable society can be developed a mean to avoid arsenic and its impacts in health

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2.2 Review of Previous Studies

2.2.1 Introduction of Arsenic and its History

Arsenic has its origin in the Syriac word “Zarniqa” from Persian word “Zarnikh” meaning yellow (gold colored). It was adopted to Greek as “arsenikon’’ a form of folk etymology, being neuter from of the Greek word ‘arsenikos’ meaning ‘male’, ‘virile’. The Greek word was adopted in Latin as “arsenicum”, which in French became “arsenic” from which English word arsenic is taken.

The symptoms of Arsenic were somewhat ill defined; it was frequently used for murder by ruling class. Due to this arsenic has been called the “poison of Kings” and the “King of poison” (Vahinda. et.al 2007).

Arsenic is a chemical with symbol As an atomic number 33. Arsenic occurs in many minerals, combined with other metals and sulphur also as pure elemental crystal. Arsenic exists in different forms with color metallic gray, yellow and black arsenic. Arsenic forms colorless, odorless, crystalline oxides As_2O_3 (white Arsenic) and As_2O_5 (called arsenate) which are the basis of arsenic contamination of ground water.

In terai areas of Nepal there had been a myth for long time that people used to migrate from one place to another concluding that the place was not suitable for residing as they were continuously attacked by different diseases. The cause remained unknown for long time. Only recently it has been realized that the cause might be the high level of arsenic present in the tube well water.

Arsenic contamination of ground water emerged unexpectedly as a major health issue in Bangladesh in the 1990's arising from what had been considered a highly successful tubewell boring project advocated for and sponsored in part by UNICEF and other organization. Although the tubewell water was microbiologically pure, the naturally occurring arsenic contamination was of such scope as to continue a public health "emergency" according to independent experts in a widely- cited article published in 2000 in *Bulletin of the World Health organization* (2013). First report of arsenic contamination was believed to be observed in 1976 in central region of India and by 1983 Arsenic problem was already confirmed. (UNICEF report 2005, 2011, 2013).

Arsenic contamination in drinking water is a global problem which drew attention only after the occurrence of "Black Foot Disease" in Tiawan caused to people drinking water containing higher concentrations of arsenic from the tubewells. Arsenic is a chemical substance which is found in air, water, soil, food etc. Arsenic which occurs naturally in rocks, soil and minerals deep inside the earth crust gets mixed with underground water by various biological and chemical processes. Different human activities like mining, excess use of arsenic containing insecticides, coal etc diffuses arsenic to our environment. When arsenic is mixed in water it cannot be seen by our eyes neither it has taste nor smell. It can only be confirmed by testing in lab or by field test kit method (Maharjan et. al. 2012).

2.2.2 Arsenic Contaminating Ground Water

While examining the water from tube well it was found that the majority of the tubewells were reported to have high iron content without pathogenic microbial contaminations but arsenic was not marked. With the emergence of As– poisoning reports (in 1998) from

Bangladesh and west Bengal (India) there was a concern over the possible As contamination in Terai ground water. Alluvial sediments deposited by rivers draining from the Himalayas have been implicated as an As source in the ground waters of Areas lying in the catchments (Juillot et. al. 1999, Bhardwaj et. al 2010). Rocks containing As are widespread across the Himalayas, including the flood plain areas of the southern belt of the Terai region (Shrestha et. al. 2003).

Arsenic can contaminate ground water naturally as well as artificially i.e by weathering of arsenic containing rocks arsenic gets oxidized to release arsenic in wastes as well as other human activities like mining, burning of fossil fuel, use of insecticides and chemicals. In Nepal the alluvial sediments deposited by rivers draining from the Himalayas have been implicated as the major source of arsenic in ground water lying in flat plain of Terai (Roman Shrestha, 2012).

Arsenic enroots for poisoning human body via water, air, soil and according to latest studies by IRRI (International Rice Research Institute) it is concluded that arsenic percolates to human cells via rice also. Thus arsenic is absorbed by all plants, despite the concentrations are higher in leafy vegetables, apples and rice (Paul Icamina, October 15, 2012). In Natural environments microbes, plants and animals can significantly transform highly toxic As (III) into less harmful As (VI) (Ahmann et. al.1994, Dhankher et.al. 2002,2003; Wang and Zhao 2009, Sharma and Sohn, 2009, Burch et.al 2010). This shows the arsenic cycling and its influences in ground water.

2.2.3 Level of Arsenic Considered Safe in Drinking Water

The World Health Organization's (WHO) threshold for arsenic in drinking water is 10 micrograms per liter which was revised down from 50 micrograms per liter. The later level is known to be seriously unsafe with risks of Cancer death. Still certain developing countries have retained the older WHO standard arguing that the new standard is too expensive and difficult to implement (UNICEF, 2013).

In Nepal the maximum level of Arsenic intake according to "National Drinking Water Quality act 2006" is 50 micrograms per liter (Maharjan et al., 2013).

Regarding arsenic concentration in irrigation water neither international agencies nor individual countries propose any recommended maximum permissible values. For drinking water, however due to the carcinogenic nature of the substance, the world health organization (WHO) has issued a provisional guideline recommending a maximum permissible arsenic

concentration of 10 mg/L (micrograms per liters). – Amal Talbi (World Bank). On the other hand many countries even Nepal retained the earlier WHO guideline of 50ppb (0.05mg/L) as her standard like that of Bangladesh and China.

Since 1958, WHO has been making guidelines for quality of drinking water. In the same year International Standard for Drinking Water established 0.02mg/L as an allowable concentration for arsenic in that year. In 1963 the standard was re-evaluated and reduced to 0.05mg/L. In 1984 this was maintained as WHO's guideline value internationally such that different countries made it as their national standard or was an interim target. Further the guideline was enumerated in 1993. (Shrestha et al., 2000).

2.3 Knowledge about Arsenic

Water quality is major concern of developing world, especially for child survival and health. Safe water must be free from harmful microorganisms and dangerous concentrations of environmental contaminants such as arsenic.

Knowledge of the potential extent of arsenic contamination and of the severity of its health effects has grown significantly in recent years. Naturally occurring arsenic contamination of ground water has been discovered in at least 70 countries to date and more than 140 million populations are susceptible to arsenic. And this discovery took place within the last 10-15 years. This trend as well reasoning based on current geological knowledge indicates that arsenic contamination will certainly be discovered in more countries and locations. The knowledge of Arsenic is still evolving. (UNICEF position paper 2013)

By disseminating knowledge on health risks associated with arsenic exposure, a successful public-awareness campaign could change health behaviors. Accordingly, the demand for safe drinking water may reflect mitigating factors, such as the presence of children, in household (Aziz et al., 2006)

Studies on ground water quality in this region began in the 1990s and were limited mainly to the analysis of tube well water for iron, ammonia, nitrate and micro organism (Sharma 1999, Gurung et al., 2007).

Ground water constitutes major sources of drinking water in many parts of the world. Therefore high level of As in drinking water has severe health effects. It is well known human carcinogen causing skin, bladders, kidney, lung and liver cancers (Karagas et al., 1998, Ng et al., 2003, Ng 2008; Ghimere 2008, Liu Waalkes 2008)

Paul Icamina (2012) writes about the presence of arsenic in food like rice though the official standard for arsenic limit on food has not been declared. Currently, only china is the country to have set arsenic limits on food as said by Joy Duldaleo, a senior researcher at the Phillippine Rice Research Institute. He also sites consuming rice rich in arsenic once a day drives human body up to 44% while two meals a day could boost up to 70% risk of being diseased. Nepal whose primary food is two compulsion meals a day arises question of the amount of arsenic entering in our body. Rice for entire Nepal is generally grown in terai region. It is often referred Terai region as "Bread basket of Nepal" thus the arsenic seems to spread whole over the country.

In her article "Arsenic a Silent Killer" in spotlight (March 2012) Lara Suykerbuyk explains about the severe water problem in Nepal and Arsenic problem in Terai. She has mentioned the harmful effects of arsenic even presence of arsenic in rice too. She has also taken reference of Nam Raj working for WHO and work done by various government and organizations as NGO, ENPHO, RWSSSP, FFF, DWSS, UNICEF, UN etc

Citing the importance of knowledge and its practice; Shrestha through his article *In Student Plus* writes training program for health personal from terai district should be launched so that they will be able to deal with the arsenicosis patient. A special course on arsenic should be designed in medical, public health, engineering and other relevant academic institutions. More operational research is needed to recommend appropriate arsenic removal techniques at small communities and household levels.

During the preparation of final draft of thesis news was published in *Naya Patrika* dated August 17, 2014 which writes "Arsenic made forced migration" the people of Kunwar VDC, Nawalparasi are migrating elsewhere from the village due to arsenic. The arsenic level in village water pumps is more than 600 ppb which is very high compared to international level 10 ppb. Also many people have lost their family members because of arsenic, and bitter fact is that the neighboring villagers deny sending their daughters as bride to Kunwar villagers. This village was declared arsenic affected area internationally and various strategies were undertaken for its remedy. All households were distributed with filters but there are no filters at present. Moreover the plans for water supply are only in the name but no service (Bhattarai, 2014).

2.4 Practice of Arsenic Removal

In 1974 Environment Protection Agency brought a concept for safety of water called Maximum Contaminant level goals (MCLG) which verifies the contaminants which are physical, chemical, biological or radiological substances or matter in water. The MCLG for arsenic is zero. The MCLG sets its health goals according to cost, benefit, and the public awareness systems to detect and remove contaminants using suitable treatment technologies.

In recent day's consumption of As contaminated ground water has become the severe health concern in many parts of the world (WHO 2009). Thus the methods dealt to solve arsenic problem are use of arsenic filters, or giving focus on nutritional diets. According to George Tassel through his research titled "Technical and social evaluation of three Arsenic removal technologies in Nepal" (January 2003); has concluded about the functioning of three types of filters, along with its shortcomings. Other researchers (Neku and Tendukar, 2003; Panthi et al., 2006) have attempted to hit upon the Arsenic problem. Similarly MIT Nepal water project was established in 1999 which welcomes various scholars to study about water and problems associated in Nepal; it also has become an experimental background as the Engineers after study come out with discovery of remedial measures and experiment itself. As for evidence Tommy Ngai, he conducted arsenic speculation test and after graduation designed his own arsenic removal technology i.e. ABF (Arsenic Biosand Filter)

"The first priority for mitigation is prevention of further arsenic exposure by providing alternative sources of drinking water. It is found that sample filtered water from KAF and SONO have negative result i.e. arsenic concentration level found to be up-to 100 ppb. Acceptance level of using KAF and SONO filter have negative result i.e. community people are not in favor of using of filters, as it is tedious for the regular using and cleaning." (Ganga Dutta Nepal, 2003-2008)

In 2010 UN General Assembly passed a resolution to recognize that access to safe drinking water as a part of Individual human right. In Nepal, the Nepal's Water Resource Act 1992 assures the right to use the same water for any other (i.e. irrigation and commercial) purpose. Also the National Drinking Water Quality Standard 2005 details the standard of quality must be applied to all drinking water source. This all persuades for the availability of arsenic free water.

Physical, chemical and biological methods have been used to decrease the concentration of arsenic in contaminated water (Jain et al., 2012). Among this method

bioremediation has been suggested to be cost effective and environmentally friendly. In this method certain bacteria that has capacity of changing arsenite (+3 oxidation state which is poisonous to human beings) to less poisonous arsenate (+5 oxidation state) or using plants that accumulates arsenic in their tissues thereby decreasing the intensity of arsenic. (Goering. P; 2013, 2015)

2.5 Presence of Arsenic in Nepal

Nepal shares the same Ganges Delta with countries like India, Bangladesh and underground water is the prime source of drinking water in Terai belts of Nepal. With the emergence of Arsenic problem in neighboring Asian countries more than half population of Nepal residing in Terai region that uses tubewell water for drinking and other household activities are threatened with arsenic problem. The investigation regarding the presence of arsenic in Nepal was first carried out in 1999 by DWSS with the financial aid of WHO in three districts i.e. Sunsari, Morang and Jhapa which came out with positive results. Following year in 2000 Red Cross carried out studies in tubewell water of 11 districts ushered further investigation and studies on arsenic must be carried out in southern terai. Similarly National and International Organization working on the field of water (DWSS, UNICEF, RWSSSP, FINIDA etc) all have tested the presence of arsenic in the tubewell under their program. In this way the program to test all tubewells of all 20 district of terai region was completed.

Till 2009 the report published by National Arsenic Steering Committee that it tested more than 11 lakhs tubewell out of which 7.5% tubewell had arsenic level more than WHO standard while 1.8% tubewell had arsenic content more than Nepal's standard i.e. 50 micrograms per liter. According to the report the maximum arsenic containing districts are Nawalparasi, Bardia, Bara etc among them also the condition of arsenic is seen severe in Nawalparasi. Arsenic concentration ranging from 10ppb -620ppb were tested using arsenic testing kits of the collected samples of Kunwar villages (Dhungana, 2008) and Kunwar village; is one of the village of Nawalparasi.

During 1980's to 1990's the Terai region of Nepal experienced severe gastrointestinal outbreaks that left thousands of people dead. The incidence forced the WHO and the government of Nepal to install tube wells to provide safe (microbiologically) drinking water. Since ground water is somewhat protected from sources of contaminates (e.g. Microbial contamination) it is considered relatively safe compared surface water. (Szewzyk et al., 2000)

The first Nepalese studies on arsenic ground water were carried out in 1999 by the Development of Water Supply and Sewerage (DWSS/WHO). In 2000 by Nepal Red Cross Society and Japanese Red Cross Society both concluded their studies with numerous evidence of arsenic in southern belt of Nepal popularly known as Terai. It compelled to accept the fact that arsenic contamination is imposing to the first level of health impact from melanosis to cancer and ultimately fatal cases. (Ram Charitra Sah, 2008)

In 1999 the first report on 'As' contamination in the ground water of Nepal from the Terai area of the country (Terai Alluvial plain, TAP) appeared (Maharjan et al., 2005). This contamination subsequently emerged as one of the biggest public health threat. (Tandukar et al., 2001, 2006, Sherestha et al., 2003)

First study regarding arsenic in Nepal was carried out on individual basis by Dr. Linda Smith, a geologist, in 2001 with the help of students of Tribhuwan University and University of Texas, at Dallas. (Witz, 2001)

2.6 Status of Arsenic in Nawalparasi

One of the districts of western development region: Nawalparasi is declared as hot spot for arsenic affected areas. According to National Arsenic test data showed 31,676 hand pumps were tested among 55,535 household, out of which 15.2%(8469) uses tubewells having arsenic more than 10 micrograms per liter, while 11.5%(6372) household uses tubewells with arsenic more than 50 micrograms per liter. Nawalparasi has many arsenic affected communities, also hundreds of arsenicosis patients have been found from health examination (Maharjan et al., 2008).

The report "Research on mitigation options of Arsenic contaminate Ground Water in Nepal" by WASH advisor Ganga Dutta Nepal (January 2011) was successful in encompassing many issues related to arsenic and directed his conclusion towards supply of piped drinking water. His research constrained on Nawalparasi lying within the Pratapur VDC ward no. 1 and 2, and Ramgram Municiplity (Ward No, 12 and 13). His research seems inconsistent in terms that all houses cannot get common solution of piped water supply and it also fails to abreast the present scenario. Though some parts of Nawalparsai even some parts of Jahada has been facilitated with piped water supply but the mitigation of arsenic seems inadequacy as the water supply is not uniform because of electricity (load shedding); next the tradition of consuming water from tubewell is prevalent as it gives cold water in soaring temperature and warm water in winter where as the water supplied through pipe will be the

stored one and not environment friendly. Thus it seems there is indeed necessity of changing the attitude and concept of farmers. Till this date more than seven types of filters have been introduced which creates more dilemma among the consumers.

2.7 Health Effects Due to Arsenic

Water is one of the prime nutrient of our food and a major constituent of living beings. Out of seven nutrients water plays a key catalyzing agent as absorption and circulation of all the nutrients of all along with other metabolic activities. Safe drinking water is very essential to human beings and other life forms even though it provides no particular nutrients. Studies shows access to safe drinking water has improved over last decades in almost every part of the world. But approximately 1 billion people still lack access to safe water and over 2.5 billion still lack accesses to adequate sanitation. Also ground water is notoriously prone to chemical and other types of contamination arising from natural and anthropogenic activities. (Adamsen and Pokhrel, 2002). There is clear correlation between access to safe water and GDP per capita.

Human health is the metabolic reflection of the intake of food items including water. The ingestion of useful materials like food and water determines the physiological condition as it directs towards either the promotion or deterioration of health. The useful nutrients absorbed from food promotes the health while the entrance or retention of unwanted materials weakens the health according to the intensity of exposure “Arsenic” is also one of the harmful substance primarily found in Terai ground water which seeps to human body through inhalation (like from air or smoke) through ingestion (i.e. from consumption of arsenic contaminated food and water) and dermal absorption (due to direct contact of arsenic compounds with skin). The main course of arsenic to human body is from food and water. The prolonged and continuous consumption of arsenic contaminated water or food has severe health effects. Till day the only carcinogen known in drinking water is arsenic thus its prolong intake will be the cause of cancer.

The total impact of arsenic on human health is determined by following factors viz. duration of absorption, excretion, retention in body, concentration and chemical composition of the element. It has been found from studies that the nutritional state of host plays important role in checking the effects of arsenic. After absorption of arsenic in the small intestine it is deposited in some organs like bones, liver and kidney. In healthy person it is excreted through maximum from urine and stool. Also salivation, perspiration, exhalation, lactation,

skin exfoliation, loss of hair and nail are also the remarkable process which helps in excretion of arsenic from body in small proportion. However the arsenic residue in skin and hair lasts for long time. Arsenic poisoning is cumulative and development of its intensity is very slow and insidious which takes about 2 to 10 years of continuous consumption of arsenic contaminated food and water to develop the symptom of arsenicosis.

The symptoms of adverse health consequences of arsenic poisoning can be categorized as acute and chronic effects. 'Shrestha' writes signs of acute poisoning manifest immediately if the dose is large enough and can occur within 30 minutes of entry into the body. Initial symptoms can include muscle pain, and weakness, followed by nausea, abdominal pain and diarrhea. Other symptoms can include numbness in hands and feet, red rashes on the skin, intense thrust, decreased urine output, drowsiness and confusion, paranoid, delusions, hallucinations, and delirium. The doses from 60 to 180 mg can lead to seizures, coma and death.

Arsenic can be classified according to 'Kshitish C. Saha' into 4 stages, 7 grades and 20 sub grades. Grading of arsenicosis helps to know the severity of disease and plan the treatment as:

a. Grade I i.e. Melanosis is reversible by withdrawal of arsenic contaminated water. Further progression to subsequent stages II, III and IV. Grades (1-6) can be prevented if arsenic contaminated water intake is ceased or chelating agent therapy is instituted, especially from grade 1-6 onwards.
b. Grade 2-6 is irreversible.
c. Chelating agents are helpful to prevent further progression of diseases, if they are used in 2, 3 and 4.
d. The use of chelating agents cannot rule out the possibility of further advancement of the disease to the stage of malignancy.

   The first visible signs of arsenicosis are skin lesions: melanosis (hyper pigmentation or dark spots on skin or Leuco – melanosis (alternate dark and light spots followed by Keratosis or localized thickening of skin and formation of wart like growth which may be occasionally painful). Ulcer or exfoliating dermatitis and even the gangrene may occur. The hands and feet may crack open and may develop into healing sores needing amputation. When a person continues to ingest arsenic, the skin develops sores or leads to fatal type of cancer of skin, lungs, liver, bladder, kidney and colon (ENPHO, 2003, 2013)

Chronic arsenic toxicity produces various cutaneous and systemic manifestations which include neurological, hematological, gastrointestinal and respiratory complications. Cutaneous arsenicosis characterizes concomitantly by pigment changes i.e. hyper and hypo pigmentation, (melanosis and leucomelanosis) and hardening of the skin (Keratosis) (WHO, 2000).

There is no clear understanding of why some members of family or community is affected, while others in the same family or community who are subject to the same contamination are not affected. (Hussain, 1999)

The symptoms of arsenicosis are classified in three stages. (Hussain, 1999; Muzumder, 1998, Shrestha, 2008)

2.8 Mitigation of Arsenic in Drinking Water

Arsenic mixed water does not have color, odor, or taste. Thus to find the presence of arsenic in water, soil, food etc, a sample test must be performed. In context of our country, the main source of arsenic is the underground water of terai region. The percentage of arsenic present in tubewell water can be tested for arsenic either by taking in lab or in field by field test kit method, laboratory method etc. Laboratory method is reliable but is expensive and not so convenient. Thus it becomes more practical with kit method. The water from the tubewell or well must be taken for test by contacting Drinking water and Sanitation Office, Red Cross or any NGO or INGO Offices which are working for drinking water.

Some of the widely used Test kit method and available in market of Nepal are:

1. ENPHO Arsenic Field Test Kit
2. MERCK Arsenic Field Test Kit
3. HACH Arsenic Field Test Kit

These are the various tools which uses similar chemical to detect the presence of arsenic. There difference is the number of sample and time taken by it to find the amount of arsenic in water. This all method have in common that chemical is required and a special alert and caution must be taken to handle the chemicals otherwise it might bring adversity.

After the detection of presence of arsenic in drinking water the best method is to avoid drinking arsenic contaminated water. Since there is no specific treatment of arsenicosis till date, thus to protect from arsenicosis one should drink arsenic free water which can be either by drinking water from tubewell or source only after processing for arsenic (where no other

alternative is possible). Some of the source of arsenic free water and the methods for mitigation are

i. For short Term solution:
   a. Arsenic free Tubewell/ Safe tubewells
   b. Improved well
   c. Use of Arsenic removal filters
   d. Harvesting Rain water
ii. For long term or Sustainable solution.
   a. Deep Tubewell (or Artesian)
   b. Piped system of water supply

Arsenic mitigation on household level faces several difficulties. An appropriate system for arsenic removal should be efficient, cheap, socially accepted, user friendly, locally available and operated without the use of chemicals. None of the arsenic removal techniques described in the international literature meets all this criteria. Arsenic removal technologies are often limited to small study areas and therefore do not contribute to the regional progress in arsenic mitigation (USEPA, 2000; Shrestha, 2008). Of the technique available, absorption process by sugarcane begasse usually involve low capital cost, simple to operate and minimal space and energy (Acharya, 2009).

In Nepal safe tubewells, improved dugwells and improved biosand filters are most popular methods of Arsenic mitigation. Since the only source of drinking water in most parts of plain area is underground water which is arsenic contaminated thus to solve this deep tubewells, distribution of processed water or harvesting rain water is practiced. The widely practice of making arsenic free is by the use of arsenic filter. For which various organizations have distributed different types of Arsenic removal filters to different number to people either free or with subsidized cost in different intervals of time. Some of the common filters are:

1. Kanchan Arsenic Filter
2. 3- Kolsi filter (it is very rarely used this days thus hard to find)
3. SONO filter

2.9 Arsenic Removal Filters in Nepal

Ordinary filters do not remove arsenic; a special type of filter “arsenic removal filter” is required. Arsenic removal filter were discovered in different intervals of time and the

modifications is still continuing. The reason for which is the existing filters are not entirely sustainable and convenience. Firstly, there was three pot system filter called 3 Kolsi filter which was later displaced by SONO filter (Developed by Dr. Munir of Bangladesh, 2001). Its working efficiency was found to be 20µg/litres (Hurd, 2001). SONO filter is distributed in Nepal by Filter for families (FFF) (Smith, 2008)

Also Arsenic Biosand filter (Kanchan Arsenic Filter) which can remove arsenic 95% (Shrestha, 2004, Ngai, Dangol et al., 2008) was the filter designed to suit social, economical and political constraints of Nepal (Murcott, 2001 & 2003). At present Kanchan Arsenic filters and SONO filters are widely practiced in terai region.

CHAPTER - III
RESEARCH METHODOLOGY

This chapter deals with the methods of data collection, the reason behind selection of study area, different techniques implemented for collection of data with brief explanation of the associated terms.

3.1 Rational of the Selection of Study Area

Nawalparasi district was chosen for the reason that it is categorized as the hot spot for Arsenic and declared severe arsenic affected area of Nepal from the various studies and earlier mentioned facts, thus people over there are vulnerable to the harmful effect of Arsenic. The study is centralized in Ward-9 of Jahada VDC as it contains multi-ethnic and multi lingual people. One reason of choosing Jahada VDC is that the other studies were not centralized over there so it would be a primary attempt to find the condition of Arsenic related cases and knowledge over there. Terai being in the hot climate, people there are the one who are much exposed to the only means of source of underground water extracted through tubewell. Underground water is contaminated with arsenic so the people there are susceptible to its effects; the mobilization of people to and from VDC's office can either spread massage easily or be informed. Diverse group can be benefited as this VDC contains 893 numbers of people (441 female and 452 male) from varying background thus the study area has multi-ethnic, multi religious, multi-lingual with stratified families or society. Also this is one of the part of hotspot arsenic affected Nawalparasi and part of terai region which government concluded as an area deprived in education. In general it is an ensemble of people from varying community in the context of Nepal. Therefore this area was chosen for in-depth study of Arsenic.

3.2 Research Design

The study is based on an exploratory cum descriptive research design. The exploratory design helped the researcher to explore the tradition of consuming water, their knowledge regarding arsenic, the disease and human culture. Descriptive design helped in describing the socio- economic condition, knowledge, attitude, and remedial measures adopted by villagers.

3.3 Nature and Source of Data

Both primary and secondary data was taken into account. Most data are quantitative. The primary data was collected from the field through interview (semi structured), observations and key informant interviews. The secondary data were collected from various published and unpublished documents, records, journals, books and articles.

3.4 Universe and Sampling

The Jahada VDC of Nawalparasi district has a population of 8459 with 4,504 females and 3,955 males residing in 1,698 houses (CBS 2011). Ward no. 9 with a population of 893 residing in 111 houses consuming water from 104 tube wells. This ward was chosen purposively for study. It is diverse in terms of culture and social groups and a hotspot in terms of arsenic effects. Researcher visited almost all houses. Interviews were conducted in all households where respondents were available. Altogether 100 households were included. Informant was the head of the family or a literate person. All the houses were contacted so the diverse group i.e. underprivileged, rich, poor, dalit, adivasi janjati, madeshi, muslim, and others living there were included.

3.5 Data Collection Technique

3.5.1 Interview

Among 100 houses from varying backgrounds all were visited in different intervals of time i.e. morning, afternoon, evening and in different timing of the day which helped to meet people live, their water consuming tradition from the tube well and knowledge about the presence of arsenic was studied through individual interview. Among the respondents depending on age sex, caste, ethnicity, income of family, occupation etc Information based on knowledge, attitude, value and different methods of filtration used were undertaken. Information was gathered by using a semi structured interviews, interview schedule, group interaction followed with formal and informal discussions with the villagers who are water consumers and related with Arsenic issues.

3.5.2 Observation

Apart from individual interview the researches tried to observe the skin condition of villagers showing various pictures related to arsenic infection if it matched with what they might have observed. Also visited the tubewells of susceptible area, its condition, ways of

making water arsenic free, or tradition of filter and hand pumps. The researcher tried to observe the things from the “natural point of view or in native way”. He tried to put eye on how the people feel and think about knowledge of arsenic and about underground water.

3.6 Data Analysis and Presentation:

Analysis included processes like classification, verifying, and drawing common conclusions. The responses or data collected was categorized edited, coded, tabulated, processed and analyzed using computer application SPSS 10. Presentation was done using mainly tables.

CHAPTER - IV

INTRODUCTION OF STUDY AREA AND SOCIO DEMOGRAPHIC BACKGROUND OF RESPONDENTS

This chapter provides brief introduction of study area and social and demographic background of the respondents.

4.1 Geographical Introduction of Study Area

Nawalparasi is one of the six district of Lumbini zone of Western Development region lying in southern part of Nepal. In Northern Hemisphere lies at $27^0$12' to $27^0$47' Northern latitude to $86^0$37' to $84^0$35' Eastern latitude. From sea level its altitude ranges from minimum 91 meters to a maximum height of 1936 meters. It has Chitwan in its eastern part, Rupandehi in western part, Palpa and Tanahun in northern part, and India's Bihar and Uttar Pradesh in southern part. Nawalparasi with total area of 2016.16 sq Km is divided into mountain, hill, inner terai and terai region. There are 70 VDCs and 4 municipalities. Out of which 35 VDCs and one municipality belongs to hill area and 35 VDCs including three municipalities lie in plain. Due to the geographical diversity, it experiences tropical, sub-tropical and temperate climate. The average temperature ranges from 20.5^0C to 36^0C. The minimum temperature drops to 4^0C and raises maximum to 44^0C. The average annual rainfall is 15884 ml which is drained in Narayani and Triveni rivers.

About 47% of Nepal's population lives in Terai region. It is estimated that 90% of population of terai region depend on underground water. Nawalparasi is one of the 20 districts of the Terai region where the problem of arsenic contamination is detected in water from tubewell. Nearly 400000 shallow tubewells have been installed here as the prime drinking water source for more than 12 million people, of which an estimated 3 to 4 million people are predicted to have been using arsenic contaminated water. Recent studies have reported that out of 20 Terai districts, groundwater in Nawalparasi has been found to be most severely affected by arsenic poisoning followed by Bara, Parsa and Rautahat district. Also ground water in Nawalparasi district exhibited highest average concentration and most wide spread arsenic contamination (SCAD, 2002, Shrestha, 2008).

Nawalparasi district is home for 6,35,973 people with annual population growth of 3.9% and with high people density (298 persons/Km²) of the total population 50.50% are

female. In this district 82.35% have access to drinking water. Literacy rate of the district is 72.87% among which 81.53% are male and 63.27% are female. Majority of population speaks Bhojpuri, Tharu, Nepali and other languages. Nepali is the common language of communication. Different religions are found among them Hindu occupies major proportion followed by Buddhist, Islam, Kirat and Christianity. (District Demographic Profile of Nepal, 2011)

Nawalparasi district which was, in the past, a part of Koliya state ruled by the Sen kings of Palpa in Medieval period. Hence Koliyas are the indigenous people of this region. The area is geographically divided such that 7 VDCs lie in mountainous region, 20 VDCs in hilly and mid terai region, while 36 VDCs and Ramgram municipality lies in terai district. Tests have indicated that the mountain and hilly regions of the district are free from arsenic contamination underground water. In the 36 VDCs and one municipality, however, acute levels of arsenic as high as 90 ppb. (Nepal Interim Standard for Arsenic being 50 ppb) have been detected. (SCAD, 2004; Shrestha, 2008)

4.1.1 Jahada VDC

The site selected for the study is Jahada VDC, ward No. 9, which has parts like Bhatauliya Bazaar, Badki Bhatauliya, Chamkipur etc as in Map (Appendix IV&V) which is in the southern side of the district. Jahada VDC comprises a total population of 11584, out of which 5581 are female and 6003 are male (VDC Profile, 2069). In context of Jahada VDC-9, total registered houses were 111 with total population 893; female 441 and male 452 (from Toilet Building Project Record). Some facts about Jahada VDC:

(i) It lies in constituency number 5 of Nawalparasi district.

(ii) Population: According to census 2011 A.D. total population is 11584

(iii) Ethnic Composition: It has mixed ethnic composition with majority of people are the migrant of hill like Brahmin, Chhetri, Janajati, Dalit and the indigenous people like Tharu, Madhesi and Muslim like in this VDC. The main religion is Hinduism, Buddhism, Islam and Christianity. Pahadi community speaks Nepali while Tharu and Madhesi speak Tharu language.

(iv) Family size: Family size differs from place to place with respect to geographical, society, culture, tradition and education. The people of the study area live in nuclear family. The average family size of the VDC is 8.04 which are higher than the national family size.

(v) Climate: This VDC has tropical climate. The temperature varies from 4^0C minimum to 44^0C in summer season. Thus it becomes extreme cold in winter and extreme hot in summer. The chances of summer loo and cold wave in winter are probable in this region.

(vi) Soil: It contains alluvial soil, which is suitable for farming. The major crops are paddy, wheat, cereal and oilseeds. The agriculture of Jahda VDC is subsistence type of farming. Since there is no proper irrigation facility despite few boring owned by private or community its functioning and condition is poor. Thus, monsoon rain plays main role for farmer.

(vii) Natural Vegetation: According to climate, tropical and sub-tropical types of vegetation are found in the district. But in the study area no worth mention natural vegetation is found, despite some orchards and tree of mango, litchi, jack fruit, sisau, simal, plum, jamun, guava, teak, ashok, etc are grown in this region.

(viii) Occupation: The prime occupation of this region is agriculture which is much traditional type. Due to peoples mobility and development of education, mass communication, poultry farming, animal husbandry, fishery farming, bee-keeping are becoming popular these days.

(xi) Infrastructure: There is no satisfactory development of infrastructure despite it is just 8Km far from Mahendra Highway. A wide gravelled 'Hulaki' road runs through midway linking headquarter. Some signs of development in irrigation, drinking water, road, electricity, communication, and housing are visible.

(x) Source of Water: The main source of drinking water of this region is hand pump or tubewell, often shallow tubewell. Few deep tubewell are also installed for irrigation.

(xi) Religious and Cultural settings: The people here celebrate the common festivals of Nepal i.e. Dashain, Tihar, Holi, Chat, Id etc and other local festival prevalent in the society. This festival plays effective role in creating a harmonious relationship among the individuals of the area.

4.2 Socio Demographic Background of the Respondents

This section deals with the social and demographic background of the respondents. It includes gender, caste, age religion etc for studying the knowledge and practice regarding the presence of arsenic in drinking water.

4.2.1 Gender

There were 100 families included in the study. From each family, one respondent was interviewed depending on the availability and relevance to the study objectives. The table below shows the gender background of the respondents.

Table 4.1: Gender of the Respondents

Gender	Number	Percentage
Woman	55	55.0
Man	45	45.0
Total	**100**	**100.0**

Source: Field Survey, 2013

As the table 4.1 shows that both men and women were included in the sample. Out of the total 100 respondents, majority were women (i.e.55). This is because mostly woman are concerned with the water related activities and household functions.

4.2.2 Age (years)

Among the 100 families interviewed there were variability in the age of the respondents. The respondents were selected on the basis of availability. The table below shows the age variation of respondents.

Table 4.2 Age of Respondent

Age	Number	Percentage
15-30	31	31.0
31-50	48	48.0
51-70+	21	21.0
Total	**100**	**100.0**

Source: Field Survey, 2013

Table 4.2 shows that almost all age group were included. Among the 100 respondent the age group 31-50 years were found to be maximum(i.e.48%) followed by 15-31 years of age(i.e.31%) this is because these groups were mainly found to operate the household functions related to water like collecting water, serving, cooking etc..

4.2.3 Religion

The religious status of people of study area was inquired and the result is presented below.

Table 4.3: Religion of the Respondents

Religion	Number	Percentage
Hinduism	93	93.0
Buddhism	5	5.0
Islam	2	2.0
Total	**100**	**100.0**

Source: Field Survey, 2013

Among the respondents 93% were found to be following Hinduism, 5% Buddhism and 2% Muslim.

4.2.4 Caste/Ethnic Group

The beliefs and the tradition are the important as its root is embedded with the caste/ethnicity which teaches people perform the daily livelihood activities. The study area's ethnic status is tabulated below.

Table 4.4: Caste/Ethnic Group of Respondents

Caste/Ethnicity	Number	Percentage
Janajatis	31	31.0
Hill Brahmin	25	25.0
Madeshi Dalits	15	15.0
Hill Chhetri	11	11.0
Pichhadabarga	9	9.0
Madeshi Brahmin	4	4.0
Hill Dalits	2	2.0
Muslim	2	2.0
Others	1	1.0
Total	**100**	**100**

Source: Field Survey, 2013

The Table 4.4 shows in this small village too there is diversity of Caste and Ethnicity. This village is comprised of various castes as illustrated in the table. Among the respondents Janajatis were in larger number followed respectively by hill Brahmin, Madeshi Dalit, Hill Chhetri, Pichhadabarga and so on as mentioned above.

4.2.5 Types of Family

The types of family plays important role in determining the number of members in a family. The type of a family governs the means and resources. The betterment of the facilities

in a family including quality of water, lifestyles inclusion of new technology etc all depends on the savings of the family which only comes after the adequacy of basic needs. Thus the type of family of respondents has been inquired.

Table 4.5: Respondents Family Type

Type of Family	Number	Percentage
Nuclear family	53	53.0
Joint family	45	45.0
Extended family	2	2.0
Total	**100**	**100.0**

Source: Field Survey, 2013

As Table 4.5 indicates that the sample constitutes majority of nuclear family i.e.53% followed by Joint family 45%. Also existence of extended family was marked but the number was very small this shows the clear evidence of changing trend of Nepalese society. Nuclear family is becoming popular.

4.2.6 Family Size

Family size or the number of members in a family determines the water consumption pattern. Larger family size needs more water or more resource thus size of family was also taken into account. Also in families with Nepali culture the consumption of water is influenced by the role of gender in family or society, considering this fact size of family was explored and the number of members with consideration of gender and age is given below.

Table No: 4.6: Respondents Family Size

Number of members	Families	Percentage
1-3	11	11
4-6	58	58
7-9	21	21
10+	10	10
Total	**100**	**100**

Source: Field Survey, 2013

From the above Table 4.6 it is crystal clear that majority of family consisted of 4-6 members which is followed by 7-9 members. The existence of extended family i.e. consisting of 10-16 members was also marked. The study area is predominated by average family size.

4.2.7 Education

Education is one of the primary factors for determining people's life style and changing behavior or to adapt new technology with awareness, even in new places. Educated people indeed plays decisive role in application of new technology. Thus educational level of respondents was explored.

Table 4.7: Educational Level of Respondents.

Literacy	Number	Percentage
Illiterate (without formal education)	28	28.0
Literate	17	17.0
Primary Level Complete	19	19.0
Lower secondary Complete	5	5.0
Secondary Level Complete	17	17.0
Higher Secondary Level Complete	10	10.0
Bachelor or above	4	4.0
Total	**100**	**100**

Source: Field Survey, 2013

Table 4.7 shows remarkable percentage of the respondents i.e. 28% is illiterate and there were only 4% who had completed higher education. It might be the cause of employment or further education that the highly skilled and highly educated individuals were not found throughout the fieldwork. The person who got informal education comprised 17% where as 19% had completed only primary education. This area is also victim of the brain drain or seeping of educational manpower to elsewhere. As whole the educational status is not satisfactory.

4.2.8 Main Income Source of Family

The standard of family or acceptance of new technology is affected by the income source of the family. The sum spared after the expenses in basic needs can only be used for enhancing the quality of life like buying filter etc. Thus to get the clue of economic status of respondents their family income source was inquired and results tabulated below.

Table 4.8: Main Income Source of Family

Profession	Number	Percentage
Agriculture	55	55.0
Business	22	22.0
Foreign employment	9	9.0
Wage labor	9	9.0
Service	4	4.0
Other	1	1.0
Total	**100**	**100**

Source: Field Survey, 2013

In terms of sources of income of the family it was found that majority of families meets their livelihood through agriculture which is 55% while 22% reported business which had premises from traditional goods, handicrafts to commodities and fancy items. This might be due to Nepal's agro based economy.

4.2.9 Occupation of the Respondent

Occupation also plays a role in determining the quality of life and drinking water is one of its ingredients whose quality depends on income source. Also the occupation affects whether the individual resides permanently in a place or visit arsenic free areas in course of his job. For which the respondent's occupational status was inquired and its results tabulated below.

Table 4.9: Respondents Occupations

Occupations	Number	Percentage
Household work	36	36.0
Farming	25	25.0
Business	15	15.0
Student	12	12.0
Wage labor	5	5.0
Ser	4	4.0
Other	3	3.0
Total	**100**	**100**

Source: Field Survey, 2013

Thus the Table 4.9 showed that more than one third (36%) respondents explained themselves engaged in household works. They were the female respondents. While the second largest group (i.e. 28%) were found to be involved in farming, a primary occupation of people terai belt.

4.2.10 Relationship with the Household Head

Since Nepali family is patriarchal thus decision making power is mostly assumed by head of the family while the matters related with operation and functioning of water is generally decided by female in a house. Considering it the respondent's relationship with their household head was studied and its result was tabulated below.

Table 4.10: Respondents Relationship with Head of Family

Relationship	Number	Percentage
Wife	38	38.0
Self	33	33.0
Son	18	18.0
Daughter in law	6	6.0
Daughter	5	5.0
Total	**100**	**100.0**

Source: Field Survey, 2013

As from Table 4.10 it was found that more than one third (38%) of respondents were wife of household heads followed by household head themselves (33%). Junior member of family such as son, daughter and daughter in law were also included in the sample.

CHAPTER - V

KNOWLEDGE OF RESPONDENT ON ARSENIC

This chapter deals with the Knowledge of respondents on presence of arsenic in the water, status of water in tube well, its depth, installation age, availability of arsenic filter, and symptoms of arsenic poisoning etc.

5.1.0 Main Source of Water in Home

The source of water in respondent's house is the prime reason behind the intake of arsenic in the family. As the intake of arsenic takes place through water so the respondent's source of water was explored and results have been tabulated below.

Table 5.1: Respondents Main Source of Water

Source of Water	Number	Percentage
Shallow Tubewell	95	95.0
Artesian Tubewell	2	2.0
Deep Tubewell	1	1.0
Water from boring	1	1.0
Tap Water	1	1.0
Total	**100**	**100.0**

Source: Field Survey, 2013

From Table 5.1 it is clear that most of the respondents i.e. 95% collected water from the shallow tubewell installed in their home or within the neighborhood premises as there is no other alternative source. Installation of shallow tubewell is popular because the boring of ground is continued until the water level is found out and they prefer to choose the spot to save money, time and to escape from uncertainty of water below, how much depth they should continue, or the chances of occurrence of sand in water.

5.1.1 Depth of Tubewell found in Study Area

This question was asked to find any relationship existed between qualities of water with the depth of tubewell or from what depth the water is extracted. Studies carried out in other countries (Bangladesh, India), even in Nepal by ENPHO (2005) concluded that the water from greater depth has posed less threat to arsenic in comparison to the water from shallow depth. 'Most of the arsenic contaminated tubewells in Saptari District were screened at depth range (25-40m)' Gharti Magar, 2008). Respondents were inquired about the depth of tubewell they were using to collect water and its result tabulated below.

Table 5.2: Depth of Tubewell (in ft.)

Depth (in feet)	Number	Percentage
Below40	5	5.0
40-50	69	69.0
50-60	18	18.0
60-70	8	8.0
Total	**100**	**100.0**

Source: Field Survey, 2013

It was found that majority of tubewell were within 40-50 feet depth which was 69% followed by 50-60 feet deep (i.e. 18%). This showed that the study site has maximum shallow tubewell because of saving money or finding the level of water also there was no assurance where will be the next spot that will be the reservoir of water. This is not a good sign as the people of research area have been practicing of making shallow tubewells which poses threat of arsenic poisoning.

5.1.2 Age of Tubewell

The date of installation of tubewell ensures the duration extraction of water from tubewell. This roughly ensures the duration of respondents exposure to arsenic through underground water. As some studies have shown the relationship between age of tubewell and arsenic concentration like; Arsenic concentration increases as the age of tubewell increases and concentration of arsenic decreases as depth of tubewell increases (Dhungana, 2008). Thus this issue was given due attention and the respondent were inquired whose result is tabulated below.

Table 5.3: Age of Tubewells (in years)

Age	Number	Percentage
1-10	56	56.0
11-20	33	33.0
21-30	10	10.0
Don't know	1	1.0
Total	**100**	**100.0**

Source: Field Survey, 2013

From the Table 5.3 it is clear that majority of the Tubewell in the research area aged between 10 years (i.e.56%) followed by Tubewell aged between 11-20 years (33%). Further there was existence of tubewell aged between 21-30 years which occupied 10%. This reveals there is probability of occurrence of arsenic poisoning symptoms as it acts slowly.

5.1.3 Respondent's View about Quality of Water they Consume

The respondents were asked to label the type to water they were consuming on three alternatives as mentioned in the table given below.

Table 5.4: Respondents View on Quality of their Water

Quality of Water	Number	Percentage
Good	24	24.0
Average	59	59.0
Poor	16	16.0
Don't know	2	2
Total	**100**	**100.0**

Source: Field Survey, 2013

As in the table 5.4 most of the respondents (i.e. 59%) evaluated their water was of average standard followed by 24% who ranked as good while 16% respondents reported it is poor. The respondents were assuring their water was good in sense they were using filtered water. The concept of what type of water and how it can be allocated very well was not clear among them.

5.1.4 Respondents Views on Factors Affecting Quality of their Drinking Water

Trying to figure out what was the reason behind their criteria of labeling the water good or bad this question was asked to the respondents and its answer have been tabulated as given below.

Table No. 5.5: Factors Affecting Quality of Water

Factors	Number	Percentage
Arsenic (extreme)	29	29.0
No problems noted	28	28.0
Arsenic (mild)	19	19.0
Not Examined	10	10.0
Using filter	6	6.0
Other (small, iron, salt)	5	5.0
Sand	2	2.0
Brings disease	1	1.0
Total	**100**	**100.0**

Source: Field Survey, 2013

According to the Table 5.5 it is clear that arsenic is the main cause behind degradation of the quality of water of the respondents. Of the total 48% expressed the presence of arsenic despite the variable in quantity. While some of the respondents were positive about the water in the sense that they have not experienced any problems were 28%. There was mixed response that some people couldn't explain the reason of their quality of water as they have not experienced 18% while other were happy explaining their water must be good as they were using filters.

5.1.5 Respondent's Familiarity with Arsenic

The knowledge about arsenic, its consequences and remedial measure is utmost requirement to prevent health problems related to arsenic. Considering these facts the respondents were checked about their concepts on arsenic and tabulated as follows.

Table 5.6: Respondents Knowledge about Arsenic

Knowledge	Number	Percentage
Yes	83	83.0
No	17	17.0

Total	**100**	**100.0**

Source: Field Survey, 2013

From Table 5.6 it is clear that majority i.e. 83% of the respondents were familiar with arsenic told they know about arsenic while 17% reported that they don't have any idea. The reason behind not knowing this may be some of the female respondents confined to household.

5.1.6 Source of Information about Arsenic

Since various agencies are working for arsenic awareness and its mitigation methodology, this question was raised to find out which media was very effective or popular in spreading news or information about arsenic. Several options were given to the respondents and their view was tabulated as given below.

Table No: 5.7: Respondents Source of Information about Arsenic

Source of Information	Number	Percentage
Health worker	48	57.8
Neighbors	12	14.5
NGO/INGO	11	13.3
Radio/TV	6	7.2
Government	5	6.0
School	1	1.2
Total	**83**	**100.0**

Source: Field Survey, 2013

As in Table 5.7 there was mixed response that majority 57.8% respondents revealed they heard about arsenic from Health Workers. Since various INGO/NGO conducted different arsenic remedy campaigns and projects for which they mobilized various persons from the locality and other sectors which included several health workers too which made the respondent unable to mention the exact body for arsenic information delivery. But the remarkable and essential presence of government in such sector was found to be negligible.

5.1.7 Respondents Views on Features of Arsenic

This question was considered to find out what the people of research area think about arsenic. Thus this question was put forward with multiple hint options and open so that the 83

respondents (since 17 respondents expressed that they have not heard about arsenic) can express their actual concept. But only 81 of them opted to answer.

Table No: 5.8: Respondents View on Main Features of Arsenic

Arsenic is:	Responses	Percentage of Cases
Water polluting agent	48	59.25
A kind of slow poison	40	49.38
Brings disease related to skin	36	44.44
Mole like marks in palm and sole of feet	20	24.69
Makes the pot reddish in color	16	19.75
Not so clear	9	11.11
Causes marks on the chest and back	5	6.17
All of the above mentioned symptoms	2	2.46

Source: Field Survey, 2013

**percentages are based on multiple responses of 83 cases*

As from Table 5.8 it is clear that majority (59.25%) of respondents explained that arsenic is water polluting agent while 49.5% exclaimed it as a kind of slow poison. Also remarkable percentage (44.44%) of respondents told arsenic as a causative agent of skin disease. There were only 2.46% who selected all as the features of arsenic and it is true also. This showed that the concept of arsenic was not exactly clear to all the respondents as only few of the respondents were found to know main features of arsenic. This might be due to lack of proper dissemination of knowledge of arsenic.

5.1.8 Respondent's Knowledge of Identifying Presence of Arsenic in Water

In order to check the respondent's knowledge about confirming the presence of arsenic this question was inquired to 83 Respondents familiar to arsenic and their responses was recorded as below.

Table No 5.9: Respondents Knowledge about Arsenic Test Method

Options	Number	Percentage
By arsenic test	79	95.2
Red layer deposition	3	3.6
Don't know	1	1.2
Total	**83**	**100.0**

Source: Field Survey, 2013

As from Table 5.9 most i.e.95.2% of the respondents expressed arsenic can be detected by performing arsenic test while 3.6% also expressed the local idea that putting water in a vessel throughout night to find a reddish brown slippery layer in the bottom or sides of vessel that was in contact with the water. This shows the effectiveness of arsenic awareness.

5.1.9 Knowledge of Respondents about the Consequence of Consumption of Arsenic Contaminated Water

In order to test the knowledge of people about effect of consuming arsenic contaminated water all respondents known to be familiar with arsenic (i.e. 83) were asked and their response has been tabulated below.

Table 5.10: Respondents Knowledge about the Effect of Arsenic

Options	Number	Percentage
Yes	75	90.4
No	8	9.6
Total	**83**	**100.0**

Source: Field Survey, 2013

Out of 83 Respondents only 90.4% reported that arsenic can bring harmful symptoms while 9.6% were not familiar about the harms. This is because no such symptoms or dreadful arsenic disease have been noted yet in the village.

5.1.10 Respondent's Familiarity with the Symptoms of Arsenic Poisoning

To find out whether the information of arsenic have brought any change to the people by making them aware about the symptoms of arsenic poisoning among themselves or others. This question was asked and result tabulated as below.

Table 5.11: Respondents Indentifying Arsenic Symptoms

Options	Number	Percentage
No	48	58.0
Yes	35	42.0
Total	**83**	**100.0**

Source: Field Survey, 2013

As from the Table 5.11 it is clear that majority of respondents 58% reported they have not seen while there were others (42%) who reported they have seen in neighboring village or in the pictures or visuals. This is because no prime symptoms have been noted in havoc or serious situation despite negligible suffers and some suspicious cases were noted.

5.1.11 Main Symptoms of Arsenic Poisoning:

In order to get the extent of knowledge about the symptoms of arsenic poisoning among the respondents all respondents were inquired and among them 75 respondent gave their views whose reactions were tabulated as follows.

Table 5.12: Main Symptoms of Arsenic Poisoning among Respondents

Symptoms	Responses	Percentage
Moles like marks on palm and sole	28	38.88
Marks on the skin	28	38.88
Cracks on the sole and hand	24	33.33

No idea	17	23.61
Spotted marks on the chest and back	10	13.88
Problems on stomach	8	11.11
All of above	7	9.72

Source: Field Survey, 2013

**percentages are based on multiple choices of 75 cases.*

As in Table 5.12 which had multiple answers set questions with prime symptoms and open to collect their views about arsenic poisoning? It was found that large no. of respondent (38.88%) gave a concept that Moles like marks appears on the palm and sole equal number of respondents told that visible marks appear on the skin. 33.33% of respondents told about the cracks on the sole and hand was due to arsenic. Only 9.72% pointed all were the symptoms of presence of arsenic and this was true also. This might be due to lack of adequate knowledge of symptoms of arsenic.

5.1.12 Respondent's Knowledge of Technique of Removing Arsenic from Water

Knowledge about the purification of water is the only weapon to get rid of the effect of arsenic thus this question was asked to all 83 respondents and their reactions was recorded.

Table 5.13: Knowledge of Respondents in Purifying Water

Options	Number	Percentage
Yes	71	86.0
No	12	14.0
Total	**83**	**100.0**

Source: Field Survey, 2013

The Table 5.13 shows that majority of the respondents (86%) revealed about knowing the idea of water purification Out of which 95.3% expressed using arsenic filter while 8.1% had wrong idea of water purification. This is because of positive effect of arsenic awareness campaign.

5.1.13 The Common Techniques Followed by Respondents to Remove Arsenic

This issue was attested to those 71 respondents who conformed about knowing the method of removing arsenic. This question was asked in order to find whether they had common idea of arsenic removal for which 71 of them responded and the collected data were tabulated as follows.

Table 5.14: Respondents Knowledge of Arsenic Removal

Options	Responses	Percent of Cases
Using arsenic filter	53	74.64
Wrong concept(like boiling, using common filter, Sodis method, using medicine etc)	18	25.36

Source: Field Survey, 2013

Table 5.14 shows that 74.64% i.e. majority of the respondents expressed arsenic can be removed by using arsenic filter while 25.36% had wrong concept i.e. they expressed through boiling, or by exposing in sunshine. This result was actually due to the use and popularity of only available arsenic filter.

CHAPTER VI
PRACTICE REGARDING THE USE OF FILTER AND FILTERED WATER

This chapter deals with the respondents practice related to the arsenic prevention, it includes the collection of water, its testing, selection of filters, using and maintenance of filter, remedial measures, complains, consumption of filtered water etc. It also explores about the gender wise practice and reasons behind not practicing.

6.1.0 Respondents Tubewell which have been Examined for Arsenic Test

To examine whether the arsenic familiar respondents performed the arsenic test to the water they use or not, this question was asked and their responses were collected to form the table given below.

Table 6.1: Respondents who did Arsenic Test

Response	Number	Percentage
Yes	63	75.9
No	20	24.1
Total	**83**	**100.0**

Source: Field Survey, 2013

It is found most (75.9%) of the respondents who were aware about arsenic had performed arsenic test to their water while a few 24.1% did not perform. Also there was interesting information that some respondents were using filter without even conducting arsenic test of the water they consume.

6.1.1 Respondent's reasons behind not Checking the Water for Arsenic

To understand the reason behind people not experimenting arsenic test of their water this question was raised among the 20 respondents who did not do arsenic test.

Table 6.2: Respondents Reason for not Testing Water.

Options	Number	Percentage
The technician did not come to check	13	65.0
Other	4	20.0
Don't know where to test	3	15.0
Total	**20**	**100.0**

Source: Field Survey, 2013

Out of the 20 respondents who did not perform arsenic test majority of the respondents (i.e. 65%) blamed the absence of technician to test the water. This is because there has been a tradition of people and the organization both visiting villages and performing sample test of the water either for research or for other purpose.

6.1.2 Status of presence of Arsenic in Respondents Source of Water

Among the 63 respondents who had performed arsenic test to find out the situation of presence of arsenic this question was asked and its result was tabulated as given below

Table 6.3: Presence of Arsenic in Respondents Tubewell

Options	Number	Percentage
Yes	57	90.5
No	6	9.5
Total	**63**	**100.0**

Source: Field Survey, 2013

Table 6.3 indicates that most (90.5%) of tubewell water was contaminated with arsenic while 9.5 % were labeled to be drinkable. This is because of the difference in acceptance of arsenic quantity to be made consumable in international level and in water of Nepal; different countries have made their own arsenic intake level. Otherwise 100% of the tubewell might be found contaminated with arsenic despite the quantity of arsenic may vary.

6.1.3 Respondent's Arsenic Testing Location or Water Testing Centre

In order to find the behavior of people regarding testing for the presence of arsenic this statement was discussed with the accessibility of filters and the responses was labeled in the table given below.

Table 6.4: Main Arsenic Testing Sites

Sites	Number	Percentage
When technician comes / home	74	74.0
Don't know	13	13.0
Other ways	6	6.0
Take to FFF Office (Filter For Families)	5	5.0
At home	2	2.0
Total	**100**	**100.0**

Source: Field Survey, 2013

Table 6.4 clearly shows that majority of respondent i.e. 74% insisted that technician comes to perform the test while 5% reported they take to FFF office. Also there was 13%

respondents who reported their anonymity regarding the testing mechanism. This is because technician or the concerned individual used to visit household to collect water sample for arsenic test. And FFF has been a popular site for its continuous and active service.

6.1.4 Situation of Routinely Performing Arsenic Test

Since facts and past studies show that the quantity of arsenic in water was not constant throughout the year but varied with seasons like in rainy and summer thus arsenic testing criteria was asked among respondents to find out whether they had a practice of performing the test regularly or not. Despite there is no exact schedule of arsenic test conduction but testing 2-4 times a year is considered fruitful.

Table 6.5: Respondents who Performed Arsenic Test Regularly.

Options	Number	Percentage
No	77	93.0
Yes	6	7.0
Total	**83**	**100.0**

Source: Field Survey, 2013

Thus it clear from the Table 6.5 that majority of the respondents i.e. 93% did not perform the test regularly while 7% used to take arsenic test at frequent intervals. This is because of economic problem, time factor and the inaccessibility of the area for the testing of water.

6.1.5 Details about the Latest Arsenic Test of Respondents Source of Water

Among the respondent who reported that they conducted the arsenic test regularly this question was asked to know what actually they meant by 'frequently.'

Table 6.6: Latest Arsenic test conducted

Options	Number	Percentage
Few year ago	5	83.33
Few weeks ago.	1	16.77
Total	**6**	**100.0**

Source: Field Survey, 2013

As from the Table 6.6 it is concluded that the result was not too satisfactory i.e. 83.33% had not retested after they have tested since a year ago and only 16.77% had done few weeks ago. This is due to lack of exact schedule for the continuity of arsenic test of tubewell water also due to the difficulty in testing procedure.

6.1.6 Respondent's Knowledge about Arsenic Filters

Since the knowledge of arsenic filter is directly associated with the defense of arsenic poisoning thus this question was inquired to the person who was familiar with arsenic. The result is summarized as follows.

Table 6.7: Use of Arsenic Filter by Respondents.

Options	Number	Percentage
Yes	79	95.0
No	4	5.0
Total	**83**	**100.0**

Source: Field Survey, 2013

From the Table 6.7 it is clear that 95% or most of the respondents were familiar about the arsenic filter. This is vigilant evidence to the proper awareness of arsenic.

6.1.7 Status of Respondents with Arsenic Filters

Being aware of the arsenic and its effect; one of the primary shield or attempt to prevent it at present is to have arsenic filter. Thus the respondents were inquired whether they had arsenic filter at home.

Table 6.8: Respondent with Arsenic Filter at Home

Options	Number	Percentage
Yes	51	51.0
No	38	38.0
Broken	11	11.0
Total	**100**	**100.0**

Source: Field Survey, 2013

It is clear from the Table 6.8 that majority of the respondents 62% had filter out of which only 51% was in functioning state on the other hand 11% was damaged. While remarkable number 38% respondent did not have such filters. This was because the filters were distributed for free of cost or at reduced price or the filter available and maintenance strategy is not fixed as different organization distributed the filter. So no single body took sole responsibility of filters. This decreased the bonding between filters and the consumers which decreased the lifespan of filters.

6.1.8 Type of Filter Used by Respondents

All the respondents i.e. 62 who had filter were inquired about the type of filter they were using. The result was tabulated as mentioned below

Table 6.9: Filters Used by the Respondents

Types of filter	Number	Percentage
SONO filter	41	66.1
Kanchan filter	11	17.7
Others	8	12.9
Arsenic biosand	1	1.6
Non arsenic filter	1	1.6
Total	**62**	**100.0**

Source: Field Survey, 2013

As mentioned in Table 6.9 among the varying options of filters ranging from SONO filter, Kanchan filter, Biosand filter, metal filter, others etc majority of respondents 66.1% were found to be using SONO filter followed by Kanchan filter (17.7%). Also there was remarkable presence of non arsenic filter .The use of SONO filter might be due to its latest distribution and its living service centre that it conducts frequent monitoring and maintenance while others faded out along with their mother organization of distributor.

6.1.9 Respondent's Source of Arsenic Removal Filters

Since arsenic removal filter is special type of filter and not found everywhere this question raised with the importance to find the curiosity of respondents and multiple choice were given along with their open answer. What practice was prevalent about the source of availability of arsenic filter and 82 respondents and their words were tabulated as mention below.

Table 6.10: Respondents Source of Arsenic Removal Filters.

Sources	Number	Percentage
From INGO	23	28.04
Available on VDC	20	24.39
(others) From market , particular	14	17.07

place, or order accordingly		
From FFF(Filters for Families)	13	15.85
Don't know	7	8.53
From government	6	7.31

Source: Field Survey, 2013

From the Table 6.10 it is clear that the respondent who got filter from INGO were larger (28.04%) while 24.39% told that it is distributed from VDC. 17.07% respondent did not give fixed location but told it can be bought in market or can be ordered. 15.85% respondent told that filters were available from the FFF office. Also there were respondent who told filters are given by government on the other hand remarkable percentage of respondents (8.53%) were there who were unknown about where the filters are found.

6.1.10 Facts behind Respondent not having Arsenic Removal Filters

In order to find out what reason prevented the villagers from getting arsenic filter this question was interrogated to the 38 respondents without filter and the result was tabulated below.

Table 6.11 Respondents Cause of not Using Filter.

Respondent's Opinion	Number	Percentage
Don't know where it is found.	13	34.2
Expensive	12	31.6
No idea	13	34.2
Total	**38**	**100.0**

Source: Field Survey, 2013

From Table 6.11 it is clear that majority of respondents (i.e. 34.2%) were unknown where it was found while 31.6% showed their dissatisfaction on its price being expensive. This is because there had been a tradition of complaining or expressing anonymity regarding this matter with expectation of getting new filters as other organization after survey had distributed filters.

6.1.11 Respondents Practice of Using Underground Water

With the purpose of knowing the scope of Tubewell water or exploring the path of arsenic to human body this question was asked.

Table 6.12: Respondents Use Underground Water for:

Usage of water	Number	Percentage
Household work	2	2.0
Irrigation	1	1.0
For all purpose	97	97.0
Total	**100**	**100.0**

Source: Field Survey, 2013

The Table 6.12 clearly indicates that majority i.e. 97% of the respondents' family used tubewell water for all purpose of water related functions. This is because of lack of alternatives or no other means of source of water except underground water.

6.1.12 Practice of Collecting Water according to Gender of Respondents Family

There is no proper mechanism for supply of water directly into the houses of most terai villages. So, water has to be fetched from the source. Realizing the fact this question was raised.

Table 6.13: Water Collector in Respondents Family

Gender	Number	Percentage
Women	73	73.0
Men	3	3.0
Both	24	24.0
Total	**100**	**100.0**

Source: Field Survey, 2013

Thus Table 6.13 clearly showed that majority of the respondents (73%) reported female members were responsible for fetching water while the participation of only male member was found negligible i.e. only 3%. This is the vigilant example of tradition of female members much associated with household works.

6.1.13 Practice of Using Filtered Water

As the filtered water is limited both in quantity and flow rate its wise consumption is necessary; to find out about its accuracy this question was asked to 62 respondents from families possessing filters.

Table 6.14: Use of Filtered Water by Respondent

Usages Filter Water	Number	Percentage
Drinking and cooking	43	69.4
Only drinking	16	25.8
For all household work	2	3.2
All of above	1	1.6
Total	**62**	**100.0**

Source: Field Survey, 2013

As Table 6.14 clearly indicates that majority of respondents (69.4%) used filtered water both for cooking and drinking while 25.8% used it only for drinking this is because of awareness of importance of filtered water.

6.1.14 Sufficiency of Filtered Water among the Respondents

The filter available were of different sizes likewise Biosand filter (KAF) while SONO filter consists of two big buckets while the family size and water usability is different for different individuals so this question was asked to all 62 respondents with filter to find whether the water was sufficient.

Table 6.15: Sufficiency of Filtered Water According to Respondent.

Response	Number	Percentage
Yes	58	93.5
No	4	6.5
Total	**62**	**100.0**

Source: Field Survey, 2013

As from Table 6.15 majority i.e. 93.5% respondents were satisfied as the water was enough because of nuclear family and wise use. Some complained about its insufficiency in the cases where number of people was high like hotels, schools, guest houses, and collection of people areas etc.

6.1.15 Awareness of Respondent's Family Members about the Filtered Water

This question was asked to find out whether every individual of the family with filters were aware about consumption of filtered water.

Table 6.16: Awareness of Respondents Family Members about Using Filtered Water

Response	Number	Percentage
Yes	57	91.9
No	5	8.1
Total	**62**	**100.0**

Source: Field Survey, 2013

Table 6.16 shows that majority of the respondents (i.e. 91.9%) reported that their family members are aware about the filtered water or arsenic free water. This can be the good example of arsenic awareness.

6.1.16 Duration of Use of Arsenic Filter by the Respondents

To find out the age of filter and peoples continuity of use of filter this question was raised among the 62 respondents and their answers were recorded as mentioned below.

Table 6.17: Age of the Filters Currently Used.

Time Span	Number	Percentage
Above 5 years	8	12.9
4-5 years	29	46.8
3-4 years	13	21.0
Less than 3 years	3	4.8
Don't know	9	14.5
Total	**62**	**100.0**

Source: Field Survey, 2013

Thus Table 6.17 clearly shows that majority of filters were of 5 years i.e.46.8% respondents had been using since 5 years while 21% respondents were using since 3 years. Also there were a few (12.9%) respondents who were using filter since 10 years. This might be the reason that different families got filter in different intervals of time or only certain families monitored their filters.

6.1.17 Respondents Mending and Repairing the Filters

Since filter is a mechanical device its proper function and sustainability solely depends on its proper monitoring, maintenance and repairing. Its capacity to filter arsenic is like “A stitch in time saves nine”. Filter should be cleaned in every 15 days interval of time or sometimes faster according to use or when the rate of discharge of filtered water decreases.

Also if the arsenic content in water is high it should be cleaned in short interval of time (Maharjan et.al 2013) (Arsenic Minimization, Resource Booklet). So this question was important to inquire.

Table 6.18: Respondents who Mend their Filters.

Response	Number	Percentage
Yes (Regularly)	30	48.4
No (Not regularly)	32	51.6
Total	**62**	**100.0**

Source: Field Survey, 2013

Results from Table 6.18 showed that majority of respondent i.e. 51.6% don't mend or check proper functioning of filter thus almost all filter seems vulnerable. This is the clear sign of difficulties in mending or cleaning the filters time and again.

6.1.18 Respondents Schedule of Mending and Checking the Accuracy of Filters

Among the 48.4% of Table No: 6.18 who claimed to have been mending the filter this question was raised to explore whether they mended the filters routinely or not. The results were recorded as mention below.

Table 6.19: Respondents Schedule of Mending Filter.

Schedule	Number	Percentage
Every week	11	17.7
Every 15 days	14	22.6
Monthly	25	40.3
More than two month	10	16.1
Don't know	2	3.2
Total	**62**	**100.0**

Source: Field Survey, 2013

From Table 6.19 it is clear that majority of respondents i.e. 40.3% did check their filter monthly while the correct allocated schedule is 15 days. And only 22.6% used to check every 15 days. This is because of the tedious checking and maintaining process of filter as one has spend time to change iron fillings, sand etc.

6.1.19 Last Maintenance of the Filters

This question was asked to 62 respondents who had filter with the view to find whether they are updated with the filter maintenance.

Table 6.20: Last Time Respondent Family Got Maintenance of their Filter.

Maintenance	Number	Percentage
A week ago	13	21.0
A month ago	26	41.9
More than two month	11	17.7
Don't know	11	17.7
More than a year	1	1.6
Total	**62**	**100.0**

Source: Field Survey, 2013

The Table 6.20 clearly showed that 41.9% respondents reported to have mended their filter since a month ago. Only a few (21%) mended their filter a week ago. Thus filters in most houses look vulnerable and water from such filter may be prone to arsenic. This is also the clear sign of difficulties in mending the filter or cleaning work.

6.1.20 Specific Member in Respondents Family Responsible for Mending the Filters

This question was interrogated to the respondents from the families with filters. As the operation, maintenance and regular monitoring of filter is a tedious and skilled task despite it is concerned with the lifespan of filter. Thus the result obtained was tabulated below.

Table 6.21: Specific Family Member who Mends the Filter

Family Member	Number	Percentage
Senior female	34	54.8
Everyone	14	22.6
Senior male	10	16.1
When technician comes	3	4.8
Elder children	1	1.6
Total	**62**	**100.0**

Source: Field Survey, 2013

It is clear from the Table 6.21 that majority of female i.e. 54.4% respondents gave the clue that females were involved in mending the filter while the involvement of only male was just 16.1% while participation of all family members was 22.6%. This is the clear example of woman's higher engagement with household works.

6.1.21 Status of Respondents Skipping the Filtered Water

As arsenic free drinking water is the only solution and skipping filtered water means allowing arsenic into the body. So this is a concerning issue for which 62 respondents having filter were inquired about skipping the filtered water.

Table 6.22: Respondents who Skip Filtered Water:

Situation of Skipping	Number	Percentage
Daily	23	37.1
Weekly	4	6.5
Exceptionally	25	40.3
Rarely	9	14.5
When not available	1	1.6
Total	**62**	**100.0**

Source: Field Survey, 2013

The Table 6.22 shows that 40.3% respondent skipped filtered water exceptionally while 37.1% had irregularity like daily for various reasons. This is due to lack of seriousness and lack of availability of filtered water everywhere.

6.1.22 Reasons behind not Consuming the Filtered Water

This question was asked in matter of exploring the reason for respondents skipping of filtered water among the 62 respondents who had filter in their houses. The respondents were given some multiple answers and an open space to express their answer too; its record was tabulated below.

Table 6.23: Respondents Reason for Skipping the Filtered Water

Condition of skipping	Number	Percentage
When it is not available	31	50.0
When the surrounding temperature is not suitable	10	16.1
Too much work	6	9.7
When in hurry	4	6.5
When it has bad smell	2	3.2
Other reason	9	14.5
Total	**62**	**100.0**

Source: Field Survey, 2013

From the Table 6.23 it is clear that half of the respondent (i.e. 50%) used to skip filtration when it is not available. Also there was remarkable complain of filtered water is not environment friendly as it is too hot during summer so people prefer tubewell water which is cold during summer and warm during winter; hence arsenic makes a way to one's body.

6.1.23 Respondent's Complaint or Feedback regarding the Arsenic Removal Filters

This statement was put to collect the views of respondent about what is making them feel about arsenic filter and what suggestions do they have. Many of the respondents expected about free distribution of filters while others asked for the extreme necessity of fixed place for mending and buying filter. They also demanded fixed place for arsenic test and its information. There hope solely goes to Government to make special policies for permanent remedy of arsenic giving due preference and subsidization to the poor people. There were also wishes about the continuous functioning INGO in this regard with awareness about arsenic and its consequences. The people there were found to be dismayed with the problems of maintaining filter which was tedious task and the insufficient amount of filtered water among large groups of people as in hotels, schools, offices etc. There was also audible sounds of people who expressed there should be distribution of medicine to the diseased and timely inspection with guidelines should be there for the distributed filters.

In general almost all respondents insisted about their aspirations for sustainable and permanent mitigation of arsenic free water supply since working with the filter was always not so accessible.

CHAPTER VII

SUMMARY, CONCLUSION AND RECOMMENDATION

7.1 Summary

This study was focused on Jahada V.D.C Ward No. 9. It explores the broad aspects of knowledge regarding arsenic, its issues and practice or behavior regarding it. In addition attempts were to find status of filters, filter maintenance techniques, people's perceptions and practices relevant to various dimensions of arsenic contamination and severity of disease. This study is mainly focused on knowledge, practice, attitude, beliefs, perceptions, mass media impact etc among villagers. This study avoids medical study of Arsenicosis but during literature study it was undertaken as reference. Altogether 100 respondents were sampled for interview purposively. The major findings of the study are:

7.1.1 Socio- Demographic Information

- The study area was one of the least developed areas of Nawalparasi with 111 houses holding 893 people consisting 441 female and 452 male.
- The average family size according to VDC profile 2069 BS was 6.3 (on considering 141 houses) and by study it was found 8.04 which were quite high as compared to National which had 3.8 according to 2068.
- Age wise most respondents belonged to 31-50 years (48%) followed by 15-30 years (31%). Among 100 respondents 55 were woman and 45 were male.
- Most i.e.(93%) of the respondent were found to be following Hinduism, followed by 5% Buddhism while in terms of ethnic group it is found that Janajati were in larger number (31%) followed by hill Brahmin (25%) and Madeshi Dalit (15%).
- Slightly more than half of families (53%) were nuclear followed by joint family (45%).
- Majority (58%) of the families had 4-6 members followed by 7-9 members in a family (21%).
- About 28% of the respondents were illiterate lacking even formal education followed by respondent who completed primary level (19%). The secondary level completed respondents were (17%).

- Agriculture was found to be the major income source of respondent (55%) followed by business (22%).
- Large numbers of respondents were housewife (36%) followed by (25%) engaged in farming while 15% of the respondents had business as their occupation. The number of respondents who were students was 12%.

7.1.2 Knowledge about arsenic and its mitigation measures

- Almost all tubewell (95%) were shallow tube well which was the only means of source of water.
- Most (69%) tube well were with depth 40-50 feet.
- Majority of respondent (59%) were dissatisfied with the quality of water.
- 48% of respondent mentioned arsenic as the factor which deteriorated quality of water while 28% believed it was average for not noticing any problem.
- Most of the respondents (83%) had heard about arsenic.
- Majority of respondent (57.8%) got information about arsenic from person who worked in health sector.
- Out of arsenic familiar respondent most of them (75.25%) conducted arsenic test.
- Most of the respondent (95.2%) knew that conformity of arsenic in water is by experimental test.
- Most of respondents (90.4%) knew consumption of arsenic contaminated water is harmful.
- A remarkable number of respondents (42%) were able to identify symptoms of arsenic poisoning.
- 86% of respondents had knowledge of water purification and most of them (90.36%) had knowledge about arsenic removal techniques.
- Most (95.18%) of the respondents were aware about that arsenic removal filters can remove arsenic from contaminated water.
- 74.64% respondent had knowledge of using the filter effectively.

7.1.3 Practice of using Filtered Water and Arsenic

- Failure of respondents (65%) to test the arsenic was because of looking for arrival of technician at their door steps.
- Among the tested water most (90.5%) tubewell water were found to contain arsenic.

- Majority of respondents (74%) performed arsenic test when technician visited.
- Only few (5%) of respondents visited arsenic testing sites.
- Regular test of arsenic was performed only by 7% respondents while irregularities in testing were maximum i.e. 93%.
- Among the respondents who had working filter were 51% while 11% had functionless filters and the rest were without filters.
- Two third of respondents (66.1%) had SONO filter followed by KANCHAN filter (17.7%).
- One third of the respondents (34.2%) did not use filter because of inaccessibility of filter while price constraint prevented (31.6%) to use filter.
- Most of the respondents (97%) used filtered water for all household purpose.
- The filtration rate was sufficient for most of families (93.8%).
- Among filter bearing families 91% were conscious about consuming only filtered water.
- The ages of filter were below 5 years (46.8%) and only 12.9% of filters were above 5 years old.
- Half of the respondents (51.6%) mended their filter regularly.
- Monthly maintenance of filter was done by 40.3% respondents while only 26.6% families managed it in 15 days interval.
- In majority (54.8%) of the household, senior member of the family cleaned and maintained the filter.
- Half of respondents (50%) skipped filtered water with reason of unavailability in all places.
- Respondents expected fixed and accessible place for arsenic related activities like awareness, testing for water, provision of filter and medication.

7.2 Conclusions

From the study it was clear that there is high possibility of arsenic contamination as majority of tubewell which is the only means of source of water was shallow type. On the other hand the knowledge of arsenic was much limited to water polluting agent they were unknown about the dreadful consequences. One satisfactory fact was most of them were aware about arsenic removal filter as solution.

The knowledge of arsenic was insufficient they knew it is harmful but were unable to explain in detail How? Why? etc. they were unknown about that even balanced diet can check the complexity of arsenic. Also the other latest arsenic removal procedure was unknown to them. Similarly they knew Arsenic filter was the solution but did not know clearly why it should be cleaned timely and How to clean? One of the prime factors affecting knowledge was education: the educational status of respondents was poor. Arsenic poisoning becomes complex with time as severe symptoms are only seen later which can easily be clear to an educated person than other. The educational status affected for acquiring in-depth knowledge of arsenic, use of filters, its operation technique, spread of knowledge of arsenic etc. The main occupation of the place was agriculture which deprived time for people in collecting information or attending trainings related to arsenic and its remedy. Arsenic has more technical terms and its information are found more in other language than in native language so to seek the information, make thyself eager to use the technology, one must have interest. Also the accessibility of information was affecting knowledge since there were no fixed arsenic information centres that can continuously keep awaking people.

Practice on arsenic remedy was average. Most of them knew arsenic filter was the solution but to dismay the number of filter bearing families were less. Some had even abandoned the filter early which might be due to tedious maintenance procedure and unavailability of broken parts of filter. The tradition of testing arsenic was quite ambiguous i.e. majority performed arsenic test only at doorstep. The reason behind this might be either those test were performed as a means of investigation by concerned researchers or to find facts by related bodies; these were ultimately stopped after completion of target. Regularity in test was poor, also only half of the families had working filter which was clear evidence of lack of optimum use. The conscious level of filter use was high but only half of the population was found to be mending filters regularly; there was no tradition of replacement of filter. The schedule regarding arsenic test and filter maintenance seemed irregular. Filtered water was sufficient for the nuclear families but insufficient in areas like school, hotels etc. The factors affecting practice were physical factors like no specific place for arsenic test (lab), no easy access to filters and its parts. The role of education in affecting practice cannot be forgotten as an educated person will be aware and up-to-date regarding arsenic test, routinely filter maintenance or reporting the advantage and disadvantage to the concern working bodies. Occupation of people always did not assure the availability of filtered water also it did not support some families with enough sum to buy filters so it affected the practice as well.

7.3 Recommendation

The knowledge level of arsenic and practice on arsenic removal was not found much satisfactory moreover few diseased respondents were also met. Thus on the basis of the research I would like to suggest following points:

a) Organization, monitoring and evaluation of awareness and knowledge building campaigns should be raised and make successful.
b) Standard and scientific filters should be managed free of cost by the government, it is not only enough, the timely maintenance should be carried out.
c) Local people be given sufficient knowledge and practices for balancing food that they intake so that the immunity power and discharge of arsenic from their body becomes strong to tackle arsenic related problems.
d) And experiment regarding the depth of tubewell should be conducted so that the deeper tubewell with less effects of arsenic water can be observed.
e) As per the research almost the local people's queries have been positively addressed though it lacks the strategies to raise the common voice against such critical conditions.
f) People of arsenic zone should strictly change their traditional life style, water utilization pattern and cultural framework of water purification, than only the society can have bright and blooming citizens for the purpose of nation building.
g) A Campaign of using Arsenic test and filter maintenance Card might be brought into practice so study and remedy of arsenic becomes quite easy.
h) Inclusion of Arsenic education in the curriculum of school level education.

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Appendix – I

Interview Schedule

"Knowledge and Practice on Arsenic"
(A Study of Jahada VDC ward No. 9)

General Demographic Information
Information of Respondents **Section "A"**

Q.No.	Questions	Answers
1.	Gender	1. Woman 2. Man
2.	Age	1. 15-20 years 2. 21-30 years 3. 31-40 years 4. 41-50 years 5. 51-60 years 6. 60 years and above
3.	Religion	1. Hindu 2. Buddhist 3. Muslim 4. Christian 5. Others.
4.	Caste	1. Brahmin 2. Chhetri 3. Tharu 4. Newar 5. Gurung 6. Magar 7. Dalit (Pahade) –i) Pariyar ii) Bishokarma Dalit (Madeshi) i) Chamar (Harijan) ii) Dushad (Paswan) iii) Yadab 8. Pichhadabarga i) Kahar ii) Kebat iii) Yadab 9. Musalman (Muslim)
5.	Type of Family	1. Nuclear 2. Joint 3. Others
6.	No. of family members	1. Male …… 2. Female…. 3. Total
7.	Education	1. Illiterate 2. Literate only (no formal ed.) 3. Primary

Q.No.	Questions	Answers
		4. Secondary 5. Higher secondary 6. Higher education (level…….)
8.	Main source of Income	1. Agriculture 2. Service 3. Business 4. Foreign employment 5. Wage labor 6. Other
9.	Occupation of respondent	1. Farmer 2. Service 3. Student 4. Housewife 5. Others
10.	Relationship with the head member of family	1. Self 2. Wife 3. Son 4. Daughter 5. Daughter in law 6. Other
		7.

KNOWLEDGE **Section "B''**

11.	What is the present source of water in your house?	1. Artesian Tubewell 2. Shallow tubewell 3. Deep tubewell 4. Water from boring 5. Tap water 6. Others …….
12.	What is the depth of tube well (ft) or in meter? (May not be asked to those who have tap as water source)	1. Below 40 ft. 2. 40-50 ft 3. 50-60 ft 4. 60-70 ft 5. Above 70 ft
13.	When was it installed? Or age of tube well	
14.	In your view, What type of water can be considered good water for drinking?	1. Good 2. Average 3. Don't know
15.	How good is the water you are using?	1. Good (GO TO Q.N 17) 2. Average 3. Poor 4. Don't know

16.	Why?	Because of 1. Arsenic 2. Sand 3. Other(smell, iron)
17.	Have you heard about arsenic?	5. Yes 6. No ⇨ **to Q 26**
18.	Where do you find arsenic?	1. Tube well water 2. Underground water 3. Don't know
19.	From where have you heard it?	1. Radio/ TV 2. Neighbor 3. Health worker 4. NGO/INGO 5. Government
20.	What is arsenic?	1. Water polluting agent 2. Brings disease related to skin 3. Causes marks in chest and back 4. Mole like marks in palm and sole of feet. 5. All of above 6. Has good knowledge 7. Has no knowledge
21.	How can we know whether there is arsenic or not in our water?	1. By arsenic test 2. Don't know
22.	Have you done arsenic test for water from your tube well?	1. Yes (GO TO Q.N 24) 2. No.
23.	Why didn't you take for the test?	1. Don't know where to test 2. The technician did not come to check
24.	Was there arsenic?	1. Yes 2. No.
25.	Do you know what happens if we consume water containing arsenic for a long time?	1. Yes 2. No.
26.	Have you seen anyone with symptoms of arsenic poisoning?	1. Yes 2. No. (GO TO Q.N.28)
27.	In your family?	1. Yes 2. No.
28.	What type of symptoms is mostly seen?	1. Marks on the skin 2. Spotted marks on skin of chest and back 3. Moles like marks on palm and sole 4. Cracks on sole and hand 5. All of above 6. No idea

29.	Do you know the technique of water purification to remove arsenic?	1. Yes 2. No (GO to Q,N 35)
30.	How?	.....
31.	What are the available ways to remove arsenic?	1. Using arsenic removal filter 2. Installing deep tubewell 3. Using tap water 4. All of above

PRACTICE **Section "D"**

32.	How do you do arsenic test for water?	1. Take to FFF Office (Filter For Families) 2. At home 3. Other ways 4. When technician comes
33.	Do you take water for arsenic test frequently?	1.Yes 2.No (GO to Q.N. 35)
34.	When did you test it lately?	1. Few weeks ago. 2. Few months ago 3. Few year ago 4. Don't remember…
35.	Have you heard about arsenic filter?	1. Yes 2. No. (GO TO 41&42)
36.	Do you have arsenic filter in home?	1. Yes 2. No. (Go to QN.38)
37.	What type of filter are you currently using?	1. Sono filter 2. Kanchan filter 3. Three kolsi filter 4. Arsenic biosand 5. ENPHO filter 6. Others
38.	From where do people get arsenic removal filters?	1. From government 2. From INGO 3. From FFF office 4. From market 5. Other….

39.	Why haven't you bought an Arsenic filter yet?	1. Don't know where it is found. 2. Expensive 3. No idea (GO to QN. NO. 50)
40.	How much capital cost would you be ready to pay for the filter?	
41.	What do You use tube well water for	1. Household work 2. Irrigation 3. For all purpose
42.	Who is responsible for collecting water for domestic purpose in your family?	1. Male 2. Female 3. Both
43	You use filtered water for	1. Only drinking 2. For all household work 3. In agricultural works as well
44.	Is the water from filter sufficient for your family	1. Yes 2. No.
45.	Are everyone in your family aware about the importance of filtered water?	1. Yes 2. No.
46.	How long have you been using the filter?	1. Since decade 2. Since 5 years 3. Since 3 years 4. Don't know 5. ……
47	Do you check and mend for the proper working of filter?	1. Yes 2. No(GO to Q.N.50)
48.	How frequently do you mend?	
49.	When was the last time you made Maintenance of your filter?	1. Every week 2. Twice a week 3. Monthly 4. Once a year 5. Not schedule
50.	Who in your house generally operates and mends filter?	1. Everyone 2. Senior male 3. Senior female 4. Elder children
51.	Do you see any difference between using and not using filter?	1. Yes 2. No (GO to Q.N.54)
52.	How often do you skip filtration?	1. Often(daily) 2. Occasionally(weekly) 3. Rarely(monthly)

53.	At what condition do you skip filtration?	1. When in hurry? 2. When it is not available 3. Too much work 4. When the temp is not suitable 5. When it has bad smell 6. Other reason
54.	Do you serve filtered water to strangers too?	1. Yes 2. No
55.	Do you have any complaint or recommendation regarding arsenic and arsenic filter?	1. Free distribution of filter should be there 2. Fixed place should be there for mending and buying of filter 3. There should be fixed place for arsenic test of water 4. Proper awareness of arsenic and its consequences should be there 5. Government should make special plans for arsenic remedy 6. INGO should work continuously for it 7. Special water supply system should be there for public 8. There should be permanent solution of arsenic remedy 9. The cleaning and maintenance of filter is tedious so proper facility must be maintained 10. There should be different mechanism for drinking for mass like in school and public places 11. Special schemes should be there for poor people 12. Permanent solution should be brought in practice 13. All of above

……. THANK YOU……

Appendix - II

Checklist for Observation

i) Source of water
ii) Nature of Tubewell
iii) Filters used
iv) Types of filter
v) Rate of filtration (Rate of flow of filtered water)
vi) Condition of filter
vii) Any prevalent symptom of arsenic poisoning
viii) Quality of water
ix) Existence of any other remedial measures (even in their view)
x) Existence of any working bodies in relation of Arsenic control

Appendix-III

Photographs

Helpless Filters

(The filters which were thrown out of house instead of maintenance)

Researcher on the Study Area

(The researcher is interacting with Ramesh's family)

****He has symptoms similar to arsenicosis***

Informal Discussion

(The researcher is holding discussion with respondents)

Arsenic Filter

(Part of arsenic filter showing lack of maintenance since long time)

At Doorstep

(The researcher collecting data from Interview of a respondent)

Water Filtration

(A respondent showing the discharge of water by Kanchan filter)

ONO Filter

(This filter is found most popular in the study area)

Writing Complaints

(The respondent writing complains)

Appendix - IV

Map of Jahada VDC highlighting the study site (Ward No.9)

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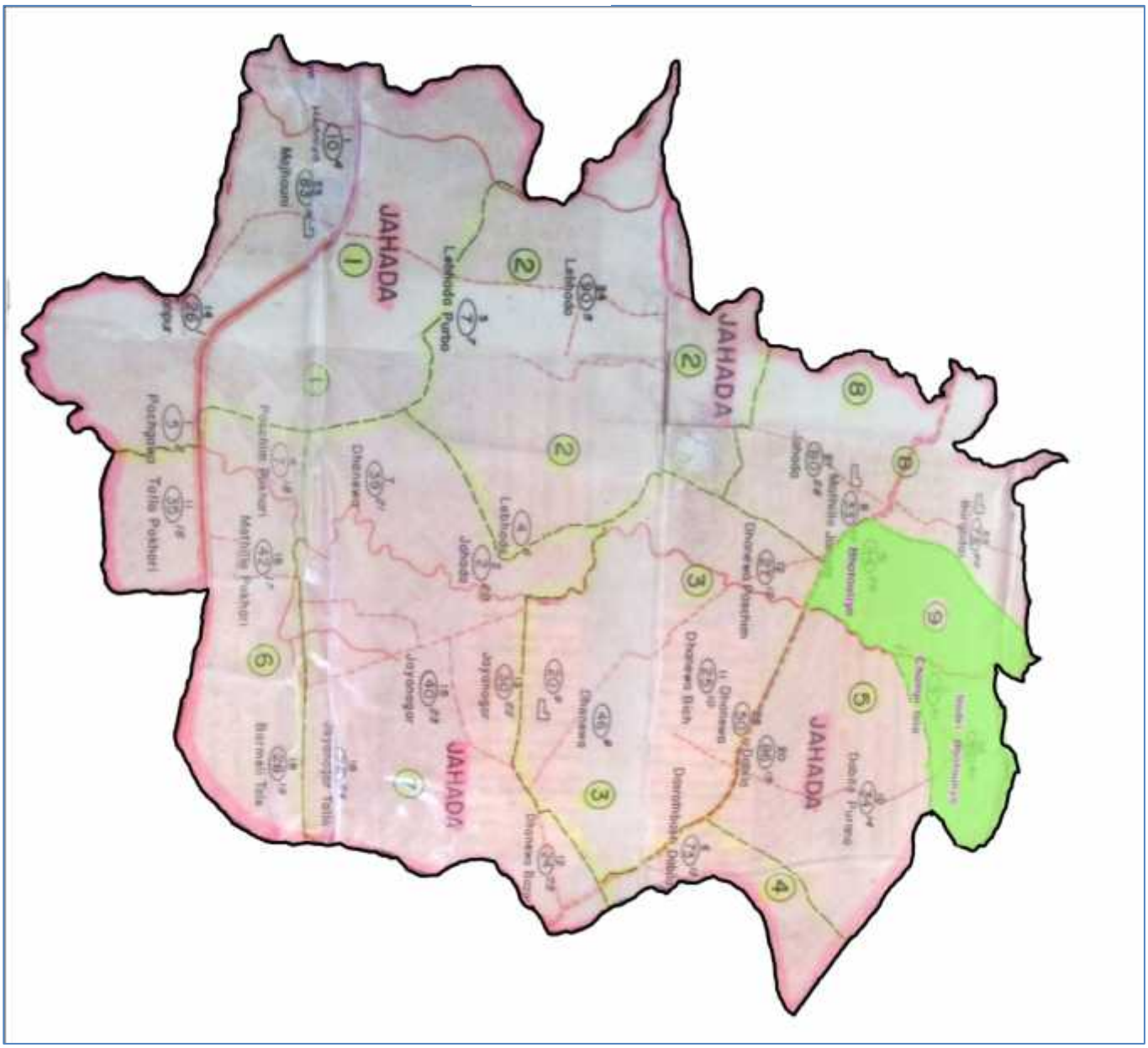

Fig. 3

Appendix-V

Map of Nawalparasi District highlighting Jahada VDC

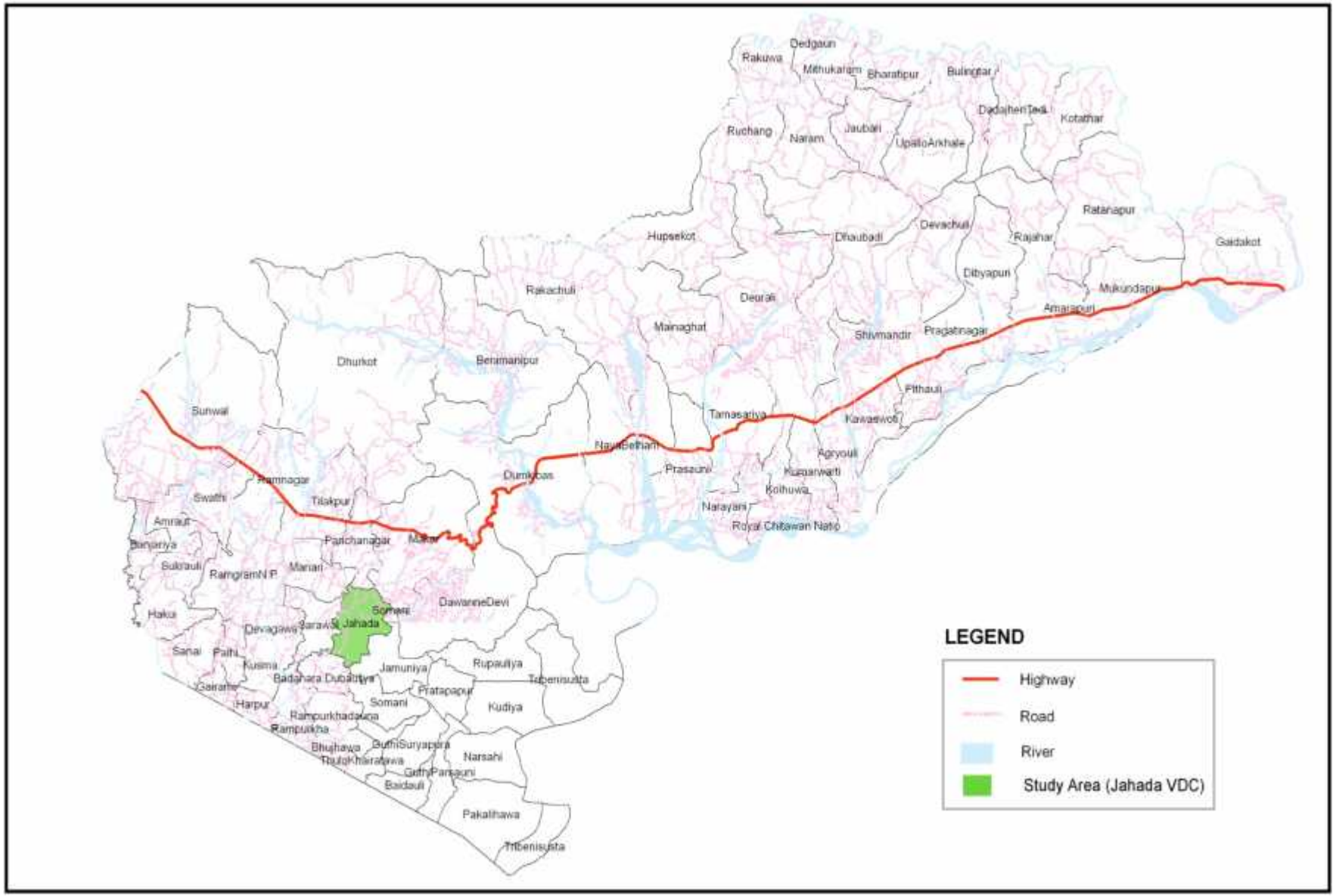

Fig. 2