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GASTROINTESTINAL EFFECTS AND THEIR CORRELATION WITH WATER BODIES OF BHOPAL

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ABSTRACT

Currently, one of most severe environmental problems is the high levels of pollution of many of drinking water bodies in India. The present research is focuses on the relationship between total coliform bacteria levels and the increase of human digestive tract diseases in the highly polluted water in the various drinking water source of Bhopal. Aim of the studied to find out what is the connection between gastrointestinal diseases and water bodies of Bhopal by conducting an online survey with questions related to the topic. This survey was particularly based for the residents in Bhopal where a total of 333 respondents were surveyed. Most of the respondents were aged 18-25 years old. Out of all the respondents, majority were the females. Around 68.5 % respondents were the local residents of Bhopal who have been there in Bhopal for around 1- 5 years. A majority of people were from the western part of the Bhopal and were also aware about the gastrointestinal diseases. The results presented here are the first of their kind of this water bodies and will serve as basis for future research exploring other similarly contaminated riparian communities. As the causes of pollution are directly related to the economic development and population growth of the region, further research should be conducted for prevention of diseases, educational programs, water remediation and conservation programs that will have a positive impact on the quality of life of the population presently at risk.

INTRODUCTION

Gastrointestinal diseases are a major global death cause, characterized by physiological and structural abnormalities in the Gastrointestinal system. These abnormalities include changes in mucosal and immune functions, alterations in intestinal gut microbiota, hypersensitivity of the visceral layer, and the development of mortality disorders. Common and serious Gastrointestinal disorders include constipation and inflammatory bowel diseases like Crohn's disease, ulcerative colitis, functional dyspepsia, acid reflux, diverticular disease, and irritable bowel syndrome. Although the exact cause remains idiopathic, genetic and pharmacological factors and unhealthy lifestyle choices, such as irregular eating, lack of physical activity, smoking, and low fiber consumption, play a crucial role in the development of these diseases.

Gastrointestinal diseases can be significantly affected by water bodies due to the presence of waterborne pathogens, pollution, and contaminants. Water bodies can serve as reservoirs for various microorganisms and pollutants that can cause or exacerbate gastrointestinal illnesses.

Mexico faces severe water pollution from untreated or poorly treated domestic and industrial waste, resulting in a variety of pollutants including suspended solids, solvents, oils, grease, plastics, plasticizers, phenols, heavy metals, and pesticides. This issue is widespread in developing countries and to a lesser extent in western regions. Studies show higher concentrations of dissolved organic carbon, E. coli, and dissolved metals in developing countries' rivers compared to Japanese rivers. [1,2]

Surface water pollution is a prevalent risk to human health and constitutes a hazard to aquatic animals and plants. The negative impact to a specific region has reached critical conditions in certain areas. It depends on the pollutant, which could be anything from organic waste to heavy metals [3]. Gupta et al. [4] state that the accumulation of heavy metals in aquatic systems has become a problem of great concern throughout the world. Trace quantities of metals present in the environment become part of various food chains and accumulate in plants and animals to levels above permissible levels to both humans and other living organisms. In these studies, the authors show that there is a significant accumulation of heavy metals in the waters, sediments and in muscles of two different fish species from different sites of the Ganges River in Allahabad, India. In addition, research done in the drainage basin of the Aral Sea (Central Asia) registered industrial and agricultural pollutants that are highly dangerous to human health. When copper, arsenic, nitrite, and dichlorodiphenyl-trichloroethane

(DDT) accumulate in downstream surface water; they reach values above the reference level in the area [5]. These contaminants already have adverse health effects in people living along the river. Agrawal et al. [6] studied the effects of pesticide pollution in riverine systems and drinking water in India. They found in Delhi, Bhopal, (and other cities), and in some rural areas a significant level of pesticides in fresh water systems and in bottled drinking water samples. The levels of DDT reported by these authors in waters from the Yamuna River in Delhi are among the highest ever reported.

Furthermore, studies carried out in various parts of the world report that potentially pathogenic microbes reach surface water bodies by the discharge of untreated domestic wastewater or by sanitary sewage leaks. For instance, in New Jersey, USA, a study determined the risk of contracting diseases because of the combined sewage discharges to the Lower Passaic River [7]. It was found that the concentrations of pathogens in the Passaic River exceed the basic criteria of water quality for human use. In addition, this water sometimes reaches sewage quality. This study found that the likelihood of contracting gastrointestinal diseases (due to fecal *Streptococcus* and *Enterococcus*) by accidental ingestion of water varied respectively from 0.14 to almost 0.70 for people visiting and doing recreational activities. Also, the exposure scenario for homeless people raises their risk of gastrointestinal disease to 0.88. Moreover, in India, most of its rivers are heavily contaminated by discharges of domestic untreated sewage and by direct discharges from industrial waters [6].

The study (in Spanish) "Environmental and epidemiological evaluation to establish health risk factors due to Atoyac River pollution" [8], reports levels of pollutants that are above the limits established in the NOM-001-ECOL-1996 [9]. García et al. [10] reported the presence of lead and arsenic in the Alto Atoyac region in Tlaxcala, Mexico by evaluating discharges of urban, agricultural and industrial wastewaters reaching the river.

Moreover, the prevalence of pollutants in the Atoyac River, especially in the Alto Atoyac region has severely affected the environment and its inhabitants' health. The main problems reported by Navarro in an epidemiological study [8] include: eye and throat irritation, colds, gastrointestinal problems, cephalea, dermatological allergies, renal problems, parasitic infections, anemia and leukemia.

The present work aims to assess the health of people living in a sub-region of the Bhopal M.P., India that presents a high gastrointestinal problem. The research focuses on the relationship between total drinking water and gastrointestinal diseases by using online survey models. It Aim of the studied to find out what is the connection between gastrointestinal diseases and water bodies of Bhopal by conducting an online survey with questions related to the topic.

METHODOLOGY

Objectives

Main Objectives of this research was followed:

1. To make 30 questions related to the topic.
2. To assemble the list of questions in the form of google form.
3. To conduct an online survey.
4. To find out how many people know that gastrointestinal diseases can also be caused due to contaminated water.

Method of data collection

The first consideration that has to be made is to find an appropriate data to be able to create an effective online survey.

Determine the objectives of the survey

The second consideration was to determine the all the objectives to complete an effective survey.

Define the required information

After the determination of the objectives of our survey, it is necessary to define what information is required, so collection of data will be done that allows to meet the objectives of the major project.

Design of the survey

Survey design consists of formulating the appropriate questions that allows to obtain the required information.

Survey question wording

The consideration of wordings of the questions is to be kept in mind. This is done by avoiding complex, vague, inaccurate, unfamiliar and technical words at all costs because they confuse respondents. Online respondents are not as patient as traditional respondents. If questions are complex or wordy, respondents will lose interest quickly.

Determine the demographic segment to study

The next step is to determine who will be the people filling the form of survey, and from whom information will be obtained.

Creating survey submission

After the survey is designed, pilot survey is used to see if there are any errors or some kind of change is needed, for example, without the questions they are well formulated and clear

Circulation of the survey

The survey of questions is shared in Bhopal to as many people as possible to generate the results. And determine the number of surveys carried out. The survey was shared by email, what's app, Instagram, telegrams, text messages or incentives to participate in the survey. A survey link on the website or generate a QR code that directs to the survey, and shared in on blogs.

Data analysis

Now after the form is circulated now the analysis of data is done. How many responses are recorded, what people think about the topic, what are their experience and many more. To analyse data and draw conclusions from the investigation.

RESULTS AND DISCUSSIONS

Age group wise distribution

According to the survey majority of the form were filled by the age group of 18 – 25 years that is 43.8%, it is clear because people lying between this category of age uses their mobiles, laptop, computers more and are active on social media more. 35.4% were between 25 – 50 years of age and 11.1% were 12- 17 years of age.

Table no. 1 - Age group wise distribution

Category	Responses
18 - 25	43.8%
25 - 50	35.4%
12 - 17	11.1%
Above 50	5.4%

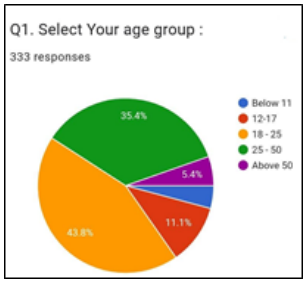


Figure 1 - Age group wise distribution

Gender wise distribution

The online survey form was filled by 61.3% of females and 36.9% of males.

Table no. 2- Gender wise distribution

Category	Responses
Female	61.3%
Male	36.9%
Other	1.8%

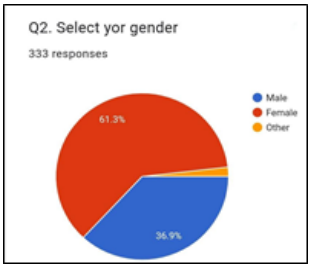


Figure 2 -Gender wise distribution

Distribution based on locality

According to our survey 68.5% of people who filled the Google form were the local residents of Bhopal and 31.5% were outsider.

Table no. 3 - Distribution based on locality

Category	Responses
Yes	68.5%
No	31.5%

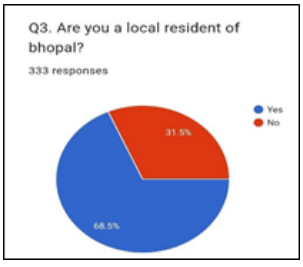


Figure 3 – Distribution based on locality

Distribution based on time period residing in Bhopal

29.5% of people who filled the form were living in Bhopal for more than 10 years, 33.6% from 5-10 years and 36.9% from 1-5 years. Majority was filling the form from their 5 years of experience in living in Bhopal rest were giving answers based on their 10 years or more than 10 years of experience in Bhopal.

Table no. 4 - Distribution based on time period residing in Bhopal

Category	Responses
1-5 Years	36.9%
5 -10 Years	33.6%
>10 Years	29.4%

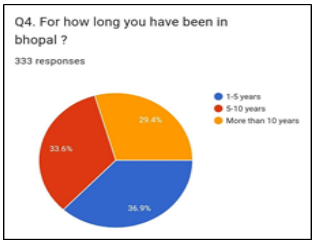


Figure 4 – Distribution based on time period residing in Bhopal

Knowledge about GI disease

The survey clarifies that 18.6% of people don't know what are gastrointestinal diseases while 42% of people mentioned probably and 39.3% people know what these diseases are.

Table no. 5 - Knowledge about GI disease

Category	Responses
Probably	42%
Yes	39.3%
No	18.6%

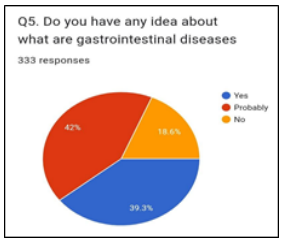


Figure 5 – Knowledge about GI disease

Area wise distribution

Form was randomly circulated in every direction / part of Bhopal and 31.2% people attempted from West Bhopal Tekri, upper Lake view point, Bhopal junction etc, 26.5% attempted from North Bhopal TT Nagar, MLA quaters Van Vihar etc , 29% from East Bhopal kamla nagar, sundar nagar railway colony etc and 13.4% from south Bhopal Idgah hills, old city, vip road, lal ghati etc.

Table no. 6 - Area wise distribution

Category	Responses
West	31.2%
East	29%
North	26.5%
South	13.4%

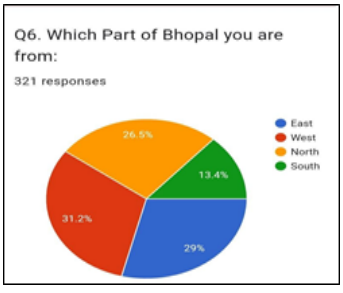


Figure 6 – Area wise distribution

Source of water supply

Sources from which people get their water supplied to their homes were the maine cause of the problem so for this question the answers were 33.3% people get water from Narmada supply, 31.2% from Kolar dam, 34.8% from Bada talab.

Table no. 7 - Source of water supply

Category	Responses
Bada Talab	34.8%
Narmada	33.3%
Kolar Dam	31.2%

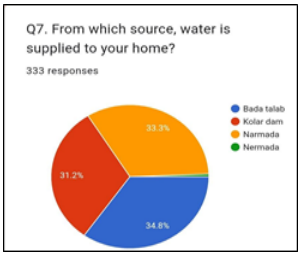


Figure 7 – Source of water supply

Distribution based on use of drinking

48.3% people prefer RO water for drinking, 33.9% drinks the tap

water while 15% prefer drinking the packed water.

Table no. 8 - Distribution based on use of drinking

Category	Responses
RO Water	48.3%
Tap Water	33.9%
Packed Water	15%

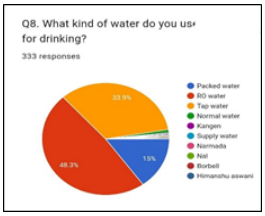


Figure 8 – Distribution based on use of drinking

Packed v/s Tap water

People's perception about tap water and packed / bottled water was crystal clear with this question, 69.1% people thinks packed / bottled water is better than tap water while 30.9% people don't think that.

Table no. 9 - Packed v/s Tap water

Category	Responses
Yes	69.1%
No	30.9%

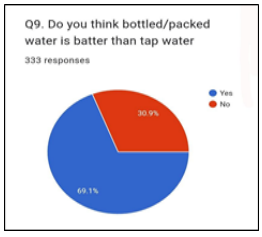


Figure 9 – Packed v/s Tap water

Health issue wise distribution

43.2% people often face health problems 41.4% don't and 15.3% said maybe yes or maybe no.

Table no. 10 - Health issue wise distribution

Category	Responses
Yes	43.2%
No	41.4%
May be	15.3%

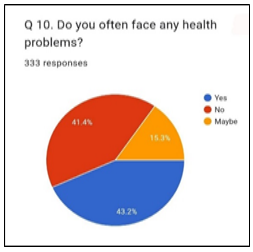


Figure 10 – Health issue wise distribution

Frequency of digestion

According to our survey 68.5% of people who filled the Google form were the local residents of Bhopal and 31.5% were outsider.

Table no. 11 - Frequency of digestion

Category	Responses
Very Rare	44.7%
Often	38.7%
Never	16.5%

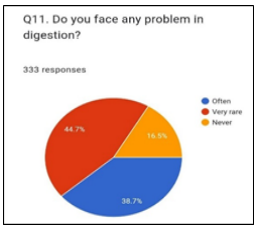


Figure no. 11 – Frequency of digestion

Disease faced by people

38.7% people often face problems in digestion 44.7% people don't face such problems very much 16.7% people never face problems in digestion.

Table no. 11: Disease faced by people

Category	Responses
None	51.7%
Typhoid	21%
Jaundice	13.5%
Ascariasis	11.1%
Amoebiasis	6.3%

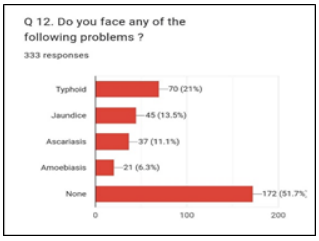


Figure 12 – Disease faced by people

Intestinal illness among household members

This is quite close question in which we asked about chronic intestinal illness among your household members and 50.5% said yes and 49.5% said no.

Table no. 13 - Intestinal illness among household members

Category	Responses
Yes	50.5%
No	49.5%%

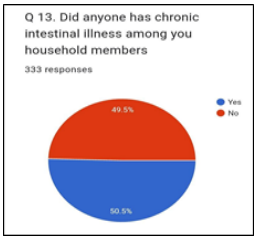


Figure 13 –Intestinal illness among household members

Knowledge about GI disease and co-relation with contaminated water

66.7% people knows about gastrointestinal diseases could be the caused by polluted or contaminated water but 33.3% of people didn't know the fact that consuming or using polluted / contaminated water can also cause gastrointestinal diseases and has harmful effects on your health.

Table no. 14 - Knowledge about GI disease and co-relation

Category	Responses
Yes	66.7%
No	33.3%

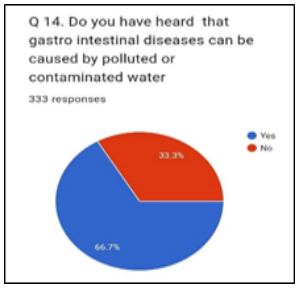


Figure 14 - Knowledge about GI disease and correlation with contaminated water

Knowledge about sewage water pipeline

On the basis of the output which found through this question we can say that mostly people think bottled/packed water is better than the tap water because it is double distilled.

Table no. 15 - Knowledge about sewage water pipeline

Category	Responses
Yes	54.4%
No	45.6%

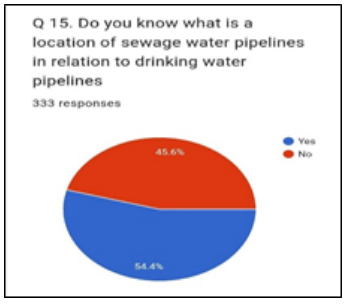


Figure 15 – Knowledge about sewage water pipeline

Frequency of having fever, vomiting etc.

On the basis of the output which found through this question we can say that 43.2% people face health issues related to gastrointestinal diseases. But 41.4% doesn't face that.

Table no. 16 - Frequency of having fever, vomiting etc.

Category	Responses
Yes	50.5%
No	49.5%

Frequency of facing mouth ulcer

On the basis of output which found through this question we can say that mostly people face digestion issue.

Table no. 17 - Frequency of facing mouth ulcer

Category	Responses
Sometimes	36.6%
Occasionally	36%
Never	17.4%
Often	9.9%

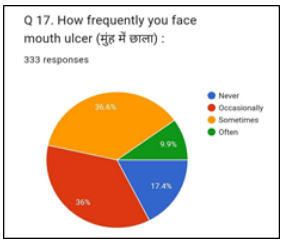
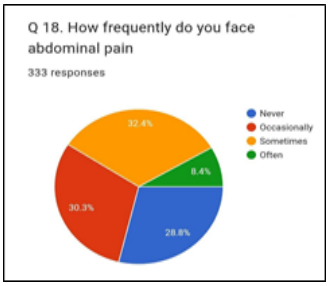


Figure 17 – Frequency of facing mouth ulcer

Table no. 18 - Frequency of having abdominal pain

Category	Responses
Sometimes	32.4%
Occasionally	30.3%
Never	28.8%
Often	8.4%



Frequency of having dysphagia

On the basis of the output which found through this question we can say that 50.5% people suffer from gastrointestinal diseases.

Table no. 19 - Frequency of having dysphagia

Category	Responses
Never	39.9%
Occasionally	37.3%
Sometimes	24.6%
Often	11.1%

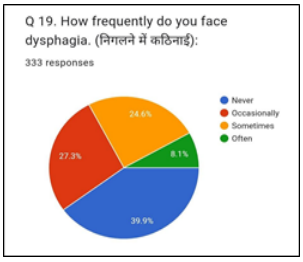


Figure19 - Frequency of having dysphagia

Frequency of having constipation

On this basis of output which found through this question we can say that 31.5% people often face constipation and 27.3% occasionally that occurs due to weak activity of digestion.

Table no. 20 - Frequency of having constipation

Category	Responses
Occasionally	31.5%
Never	30%
Sometimes	27.3%
Often	11.1%

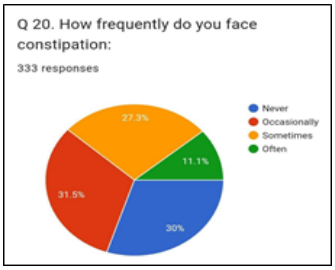


Figure 20 - Frequency of having constipation

Frequency of having bloating

On the basis of output which found through this question we can say that 41.7 % people never face bloating so it is rare, in half population.

Table no. 21 - Frequency of having bloating

Category	Responses
Never	41.7%
Occasionally	24.9%
Sometimes	22.8%
Often	10.5%

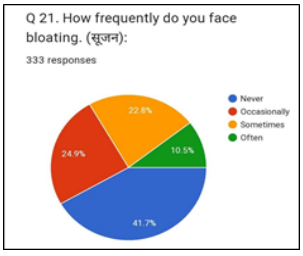


Figure 21 - Frequency of having bloating

Frequency of having hair fall

On the basis of output, we can say that ¾%part of the population face hair fall that is majorly problem which we see though survey.

Table no. 22 - Frequency of having hair fall

Category	Responses
Yes	72.4%
No	27.6%

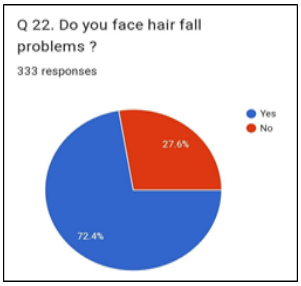


Figure 22 - Frequency of having hair fall

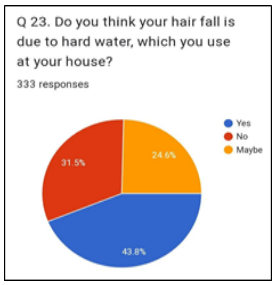
Opinion on effect of hard water on hair fall

On the basis of the output which found through this question we can say that 43.8% people think hair fall occurs due to hard water because calcium percentage is high in hard water

Table no. 23 - Opinion on effect of hard water on hair fall

Category	Responses
Yes	43.8%
No	31.5 %
May be	24.6%

Figure 23 –Opinion on effect of hard water on hair fall



Satisfaction with quality of water

On the basis of output which found through this question we can say that 26.7% people are satisfied with quality of water, but majorly face gastrointestinal diseases so we can say that awareness is very low

Table no. 24 - Satisfaction with quality of water

Category	Responses
Could be better	46.1%
Yes	27.3%
No	26.7%

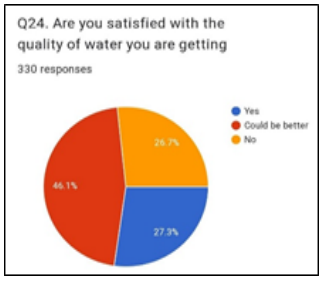


Figure 24 – Satisfaction with quality of water

Practices done to improve water quality

On the basis of output which found through this question we can say that 23.9% people don't do anything to improve quality of water which is dangerous that also occurs sometimes due to low financial status.

Table no. 25 - Practices done to improve water quality

Category	Responses
Using Filters	30.6%
None	23.9%
Water neutralization	16.1%
Installed filters	14.8%
Replaced old pipelines with plastic	14.5%

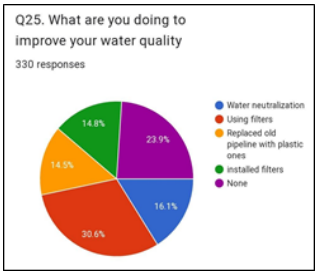


Figure 25 – Practices done to improve water quality

Thoughts about contamination of water

On the basis of output which found through this question we can say that 42.6% people know about the contaminated water.

Table no. 26 - Thoughts about contamination of water

Category	Responses

No	42.6%
Yes	31.2%
May be	26.1%

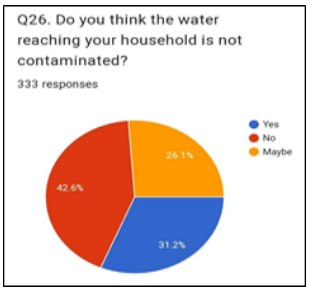


Figure 26 – Thoughts about contamination of water

Frequency of change in smell of water

On the basis of the output which found through this question we can say that mostly people notice the change of smell, taste or appearance in drinking water.

Table no. 27 - Frequency of change in smell of water

Category	Responses
Yes	52.9%
No	34.5%
May be	12.6%

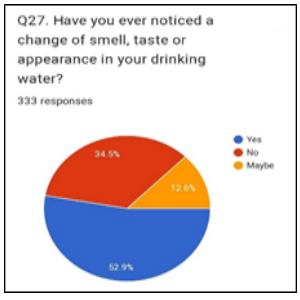


Figure 27 – Frequency of change in smell of water

Frequency of purity test of water

On the basis of output which found through this question we can say that mostly people don't test the drinking water on having a gastrointestinal disease it can received major health problem.

Table no. 28 - Frequency of purity test of water

Category	Responses
No	52.3%
Yes	47.7%

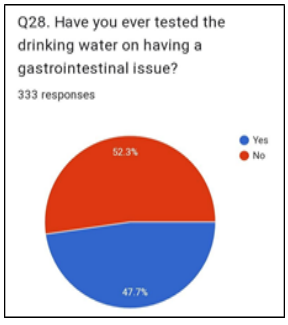


Figure 28- Frequency of purity test of water

Table no. 29 - Frequency of having sour throat and acidic taste

Category	Responses
Yes	52.3%
No	47.7%

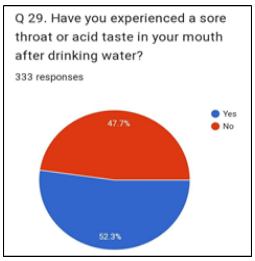


Figure 29 – Frequency of having sour throat and acidic taste

Intensity of GI disease experience

On the basis of the output which found through this question we can say that mostly people experienced mild gastrointestinal issue this indicates that now it current situation is less harmful, but it major problem, it can become very dangerous in future.

Table no. 30 - Intensity of GI disease experience

Category	Responses
Mild	45%
Moderate	42.3%
Severe	12.6%

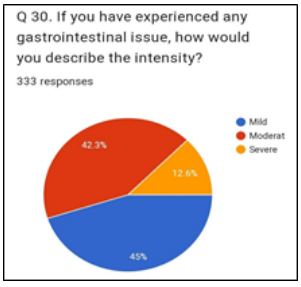


Figure 30 – Intensity of GI disease experience

CONCLUSION

This survey was particularly based for the residents in Bhopal where a total of 333 respondents were surveyed. Most of the respondents were aged 18-25 years old. Out of all the respondents, majority were the females. Around 68.5 % respondents were the local residents of Bhopal who have been there in Bhopal for around 1- 5 years. A majority of people were from the western part of the Bhopal and were also aware about the gastrointestinal diseases. We considered water supply sources namely Narmada, Kolar dam, and Bada talab out of which Bada talab is the most common among the households. 50.5% people have experienced chronic gastrointestinal diseases out of which mouth ulcers were more frequent followed by constipation, abdominal pain and dysphagia. It can be seen that Ro water is preferred over tap water as people are aware about the gastrointestinal diseases which can be caused by them. We can see that people are aware of the water and its relation with causing several gastrointestinal diseases but are not aware of the appropriate measures or methods to deal with it. Out of all the respondents, at some point or the other they have faced typhoid which can be said is due to type of water they intake. However, for reducing the possibility of the gastrointestinal diseases the water bodies should be cleaned. This can be done by various preventive measures such as disposing the toxic chemicals properly. Plastic shopping bags and plastic rings from six-packs of beverages cause inordinate problems in the nation's lakes and seas. Plastic bottles can last for decades in the water. Buy some reusable cloth or plastic grocery bags instead. Plant some trees as the trees reduce erosion that washes pollution into the water and reduces erosion. You can also volunteer your time in a local tree-planting effort. If you own land along a river or pond, plant trees, bushes, or grass along the bank. Report people who pour oil in storm drains, toss bags of trash in a stream, and so on. From the bigger picture of the survey it can be seen that people aren't aware about the measures they can take to

filter the water reaching their home. Different methods like boiling the water, which removes all the impurities from the water and the high temperatures causes virus and bacteria to dissipate. Another common method which is easy and effective is to simply strain the water through a cloth or micro porous sieve to remove the impurities. A water purifier can be used, which is till date the best water purification method. It involves UV and UF filtration along with the carbon block to remove all the impurities in the water. Reverse osmosis can also be used that forces water to pass through a semi permeable membrane, removing all the contaminants present in the water. Another technique is water chlorination which involves a mixture of mild bleach along with 5 percent chlorine is added to the water which works as an oxidant and kills the microorganisms. Desalination can also be used when certain level of salinity has to be removed from the water. Activated charcoal can be used by simply putting charcoal in a cloth bag or sock and pouring water through it. It can store toxic compounds and reduces fluoride and heavy metals from the water. People can install filters at home considering their budget to purify water. There are different types of filters which include- under sink filters, on counter filters, faucet integrated filters, faucet mounted filters, refrigerator filter, water filter pitchers. Out of which the water filter pitchers are inexpensive and easy to use. They are filled from top and have built in filters.

LIMITATIONS OF THE STUDY

The following problems we face during the survey are as follows as:

- People has fear about cybercrime so they don't do trust easily on this survey then we gain them trust by explaining the purpose of this survey and promise them it is not harmful them.
- People don't want to share their personal detail about health from anyone so we request them to maintain trustworthiness, and we don't share their information to anyone and don't judge them.
- We request to everyone to give screenshot of their response.
- It is difficult to organize a huge number of data according to age, gender and experiences.

RECOMMENDATIONS OF THE STUDY

The recommendations to overcome the problems are as follows:

- During working on this we see a lot of issue which happens due to lower quality of water and pollutant water. These problems face by Bhopal citizen. These issues now in moderate state but if we won't take precaution then it will become dangerous for community.
- So, we recommend some technique for improving the quality of water. It is basic thing and low-cost treatment which can preferable for anyone. The following techniques are as follows
- Use potash alum (fit Kari) to remove pollutants from water. It is very simple, easy, low cost remedy which can preferable by anyone who belongs lower financial status.
- Don't mix industrialised use water or pollutant water in river water.
- Separate the sewage water line to drinking water line.
- Use boil water for drinking, it helps to improve water quality.
- If it is possible so then Use the RO for control the gastrointestinal diseases and prevent them for maintain the health and become healthy.

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