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WATER CONTAMINATION AND PRACTICAL TREATMENT METHODS IN INDIGENOUS ECUADORIAN SHUAR COMMUNITIES

Zoe Sheppard

INTRODUCTION

People all around the world, for a variety of reasons, lack access to safe drinking water. In fact, 1 in 3 people worldwide do not have a steady source of safe drinking water -- that's about 2.2 billion people within our global population of 7.7 billion (UNICEF, 2019, June 18). Indigenous communities are often subject to contaminated water sources with few options for practical solutions, and one example of this can be seen throughout Indigenous communities of Ecuador. For example, in a 2014 study of determinants of diarrheal disease within Shuar communities of Morona-Santiago, Ecuador, it was found that in children ages five to ten there is a 21.1% prevalence of acute diarrhea. In the study of 150 children, it was determined that a lack of sanitation measures contributed to the instances of diarrheal disease. These include a lack of hand washing before eating, lack of hand washing after going to the bathroom, consuming unboiled water, and living with domestic animals (de los Angeles Morocho Zambrano, Diaz, & Ignacio, 2017). With diarrheal disease being a leading cause for death for children under the age of five worldwide, it is crucial that proper measures are taken to prevent these occurrences (UNICEF, 2019, October).

Water pollution within Limon Indanza, where the Shuar communities are located, comes from various sources and has detrimental impacts on the health of the Indigenous Shuar communities.

The Yunganza River, which runs through Limon Indanza as well as the Shuar communities, is highly contaminated due to the sewage system that was originally created for the city of Limon in 1935. The river was used as a vent for the sewage of the general city and as a result, the river became highly contaminated with organic material (Municipal Government of Limon Indanza, 2016, April 14). Additionally, cattle farming is the most common and profitable income generating activity in the area as it ranks as the second highest contributor to the overall GDP of Ecuador (Ministry of Environment, 2014, June 2). Studies have shown that Shuar families living in close proximity to livestock are more likely to contract acute diarrheal disease due to the ways in which

cattle manure and other organic materials used in cattle farming make their way into the main river, which is the source of drinking water for the Shuar communities (de los Angeles Morocho Zambrano, Diaz, & Ignacio, 2017). In order to decrease the occurrences of diarrheal disease within Miguel Chiriap (a Shuar community), an increased implementation of sanitation practices surrounding water consumption is imperative.

There are a few different methods of water treatment that are encouraged amongst low-resource communities which were investigated for this study; chlorination, water boiling, and homemade water filters. Chlorination includes inserting doses of chlorine into drinking water

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either directly or at various points within water pipes. The concentrations of chlorine that are used for household drinking water treatment are effective at killing most bacteria and viruses that would normally cause diarrheal disease, but not all. Specifically, chlorination is not effective in removing protozoa, such as *Cryptosporidium*, which is a microscopic parasite that causes diarrheal disease (Centers for Disease Control and Prevention, 2014, April 23). Chlorination is currently implemented within the Shuar community of Miguel Chiriap as it is placed in various points of the water piping system for the community. Still, community members report incidents of diarrheal disease in their children.

The method which is most commonly known by Shuar community members is water boiling. Boiling water is widely accepted as the most effective treatment method in removing all organic material, if done correctly. As chlorination is effective in removing most bacteria, but not *Cryptosporidium*, bringing water to a full rolling boil for 1 minute (or 3 minutes if you are at an altitude above 6,500 feet) does successfully kill *Cryptosporidium* (Centers for Disease Control and Prevention, 2009, February 20). The final method investigated for this study is water filtration, specifically the usage of a homemade Slow Sand Water Filter. This filter is made up of layers of sand and gravel in a concrete or plastic container, and when used correctly, studies have shown it to produce 99% bacterial and protozoa reduction (Centers for Disease Control and Prevention, 2012, March 21).

METHODS

The timeline for which this research was conducted is as follows:

January 2019

- Collect data through interviews and participant observation in Miguel Chiriap

January 2020

- Continue data collection process
- Test different prototypes for a homemade Slow Sand Water Filter
- Finalize prototype
- Host educational workshop involving 6 parents of Miguel Chiriap

The participants of this study, 15 in total, included 10 community members of Miguel Chiriap, 2 medical professionals, 1 municipal government employee and 1 member of a neighboring Shuar community. Of the 15 participants, there were 8 female and 7 male, and 13 of the 15 participants were parents. Participants ranged in age from 21 years of age to 60. Participants were selected to participate in this study through convenience sampling based on their availability, willingness to be interviewed, and familiarity with water systems in Miguel Chiriap.

All participants self-selected into the interview process and were informed of the ways in which their responses would be included in this research. Formal interviews for this study were conducted under the guidance of a university professor and covered by the IRB approval for the ANTH 4300 course, during which the interviews took place. Participants were asked for consent to be audio recorded during formal interviews and translators were present in order to assist with the language barrier. Beyond the interview process, participant observation was employed daily over a period of two weeks during January 2019 and again in January 2020. For participant observation, two weeks were spent working with community members of Miguel Chiriap and building relationships with them. During participant observation, the water collection, usage, and treatment process was witnessed in order to gain understanding of the community's relationship to water.

RESULTS

Data shows that community members of Miguel Chiriap understood their water was contaminated, as they cited several different sources that they

believed caused contamination including cattle farming, sewage, and resource extraction (seen in Figure 1).

Community Understanding of Sources of Water Contamination

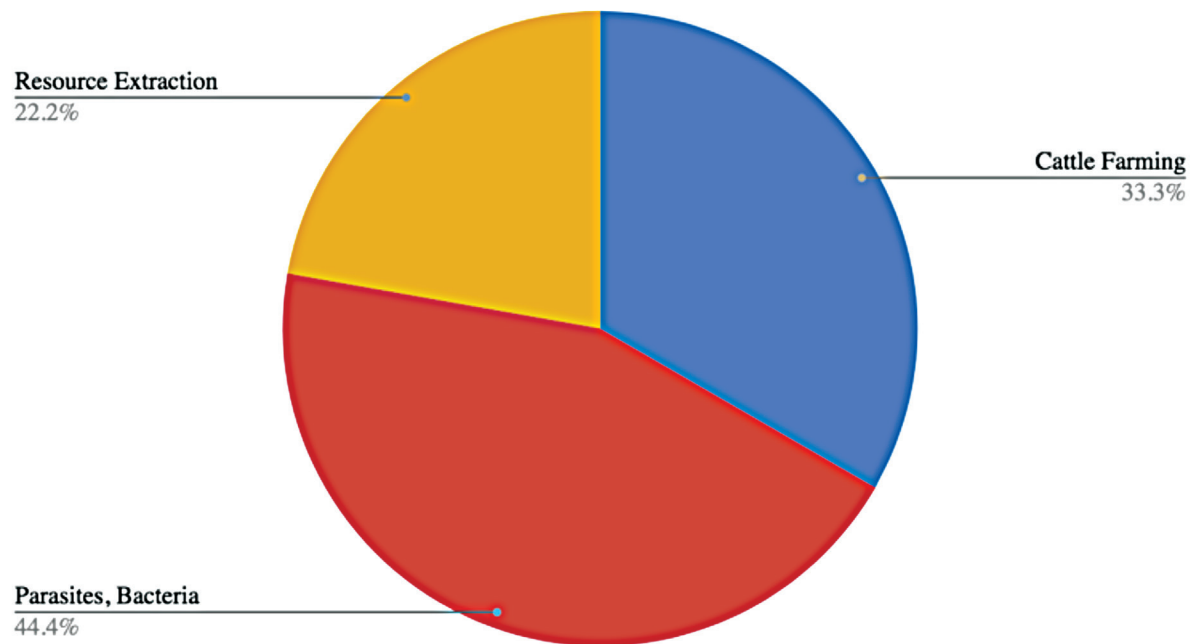


Figure 1. Community Understanding of Sources of Water Contamination

Additionally, community members strongly believed that there was a link to the water they consumed and the rate at which their children became ill. When asked to describe the water treatment methods that would mitigate the risks associated with water contamination, 100% of

community members in Miguel Chiriap stated water boiling as the treatment method with which they were most familiar (as seen in Figure 2), but 100% of community members also stated that they did not employ this practice regularly because it lacked practicality.

Methods of Water Treatment: Community Perspective

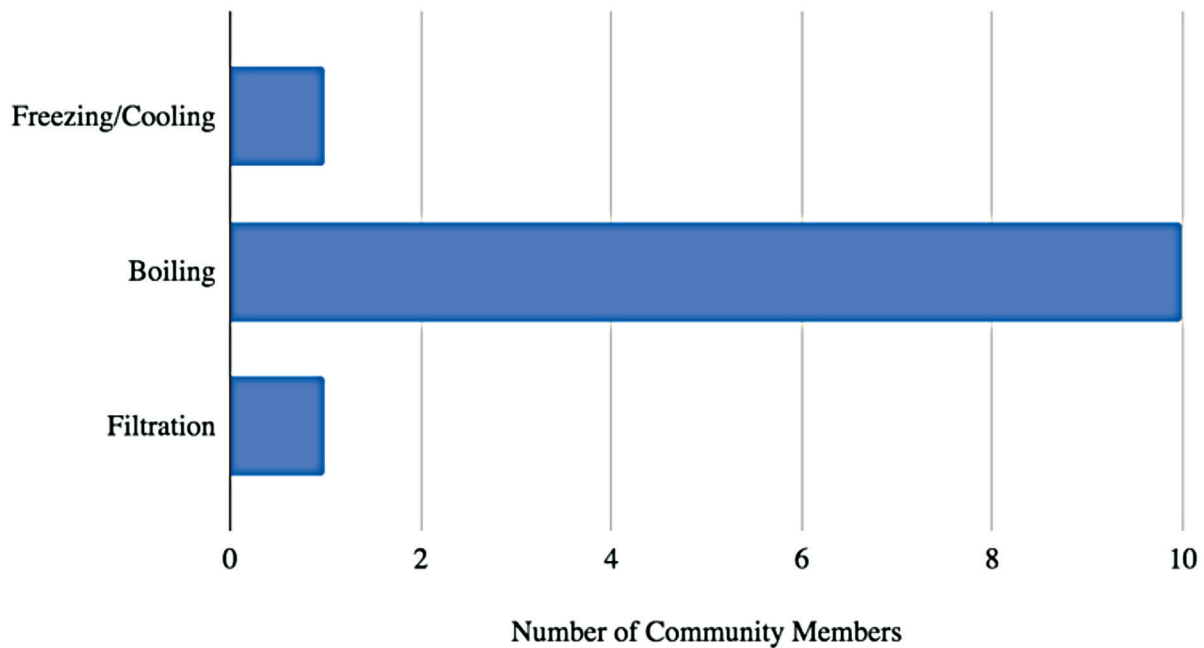


Figure 2. *Methods of Water Treatment: Community Perspective*

One community member also explained that he had heard freezing or cooling water was an effective treatment method, but that he did not personally employ this. When asked if a water filter option would be more practical and useful as a water treatment method, 100% of parents stated that they would be interested in employing this method.

One community member in Miguel Chiriap explained that he had owned a water filter before which used sand, carbon, and rocks to treat the water. He explained that the filter was gifted to him and that he used it very often: “the water I put into the filter was yellow and the water that came out was clear” (Father in Shuar community Miguel

Chiriap). This community member was able to explain the materials needed for the filter, and he explained that this method is much more practical and appealing than the boiling method. This information ended up being extremely helpful, as his prior knowledge of the materials needed for a water filter guided much of the research and design for the final product used in the pilot project.

Clinicians explained that general organic material and parasites contaminated the water throughout the Shuar communities (seen in Figure 3) which is why boiling water is highly encouraged.

Clinical Understanding of Sources of Water Contamination

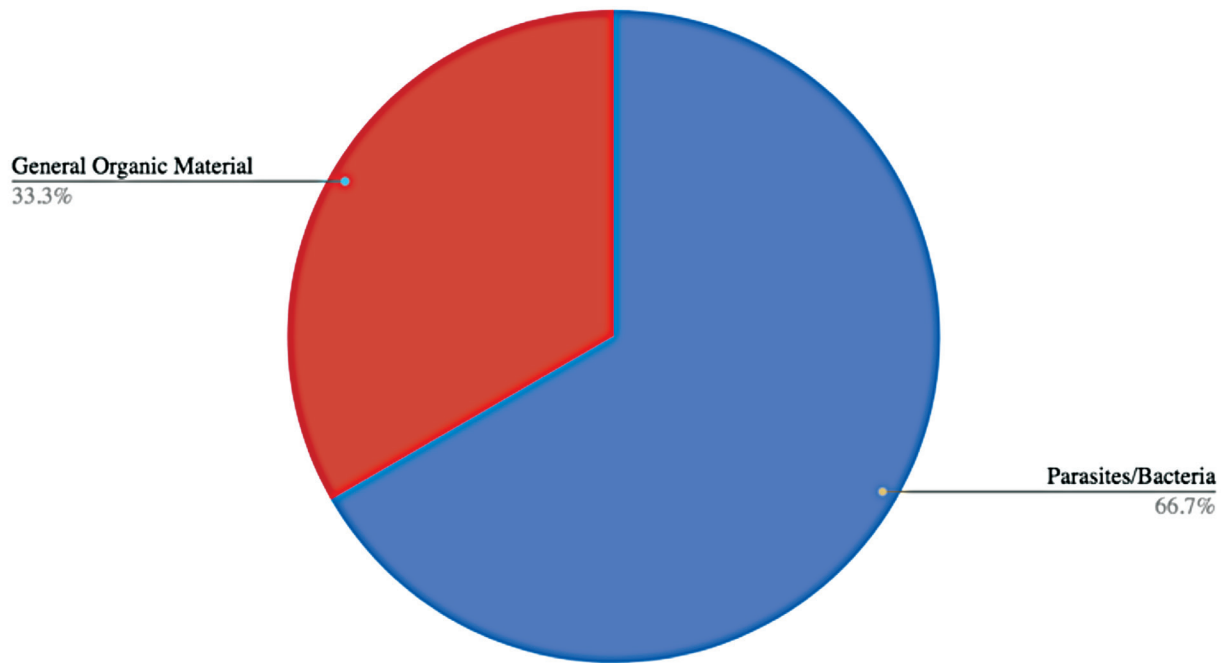


Figure 3. Clinical Understanding of Sources of Water Contamination

When asked which specific parasites contaminated the water, one clinician responded that he could not name all of the various strains as “there were too many” (local clinician working in the Shuar communities). The clinician further explained that, as a way to combat some of the parasites and bacteria that people ingest from the water, a deworming pill is administered to all students in the schools every 6 months. This pill is available to

everyone in the community, but the clinic focuses on vulnerable people in the population such as children, pregnant women, and elderly people.

When asked to describe the water treatment methods that are encouraged to mitigate the risks of the contaminants, clinicians were most familiar with boiling (seen in Figure 4).

Methods of Water Treatment: Clinical Perspective

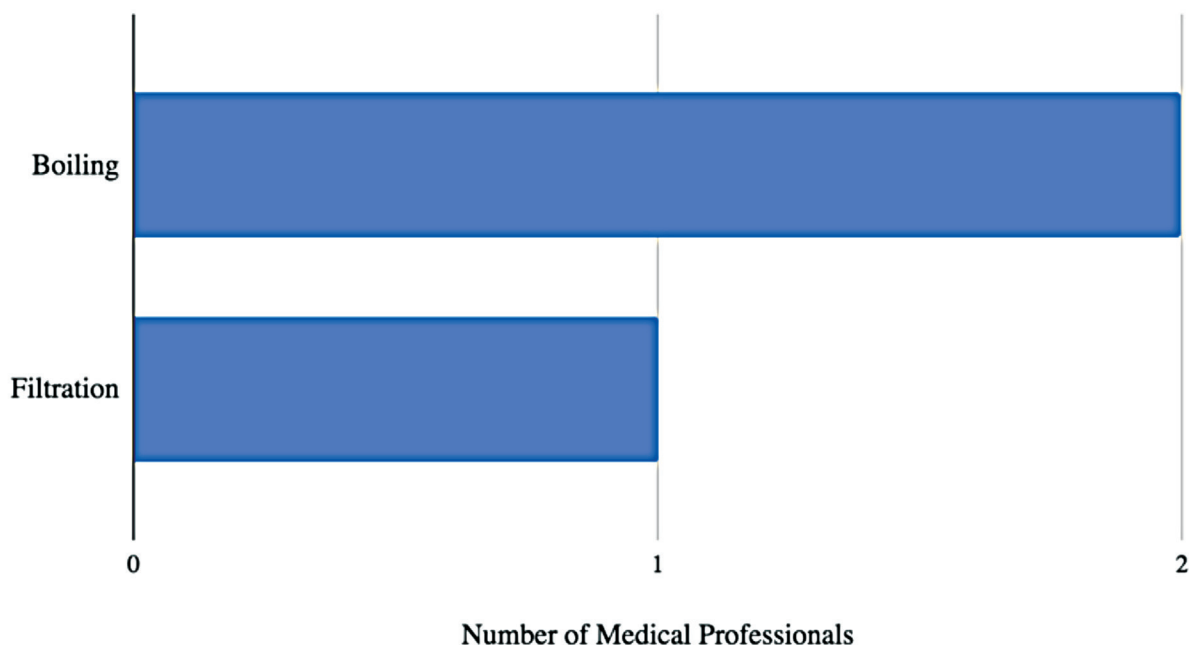


Figure 4. Methods of Water Treatment: Clinical Perspective

One clinician was aware of water filtration but was not familiar with the technicalities of how to create a homemade water filter. The clinicians further explained that educational workshops are also organized and demonstrated by medical professionals in order to continuously encourage the regular employment of water boiling and hand washing as a precaution against diarrheal disease.

DISCUSSION

The threat of contaminated water with few solutions for practical treatment poses serious health concerns for the Shuar community of Miguel Chiriap as well as neighboring communities. The organic material which contaminates the Yunganza river, the main water source for Miguel Chiriap, can cause diarrheal disease upon consumption. This is a concern for the Shuar communities as diarrheal disease can be deadly in children under the age of 5 (UNICEF, 2019, October). There are several sources which contribute to the prevalence of organic

contaminants in the Yunganza river, such as cattle farming and sewage systems. Proper sanitation measures are required to ensure that these factors do not harm those consuming the water. The method which is widely encouraged by medical professionals to be employed within the Shuar communities, including Miguel Chiriap, is water boiling, as it is known to effectively remove all pathogens, including parasites (Centers for Disease Control and Prevention, 2019, July 12).

Although community members of Miguel Chiriap are very familiar with water boiling as a water treatment method, they also explained that boiling their water before consuming it each time is not practical and is therefore not often employed by most families. Parents indicated that they made more of an effort to boil their water if they knew it would be exclusively consumed by their children, but that in general, water is not boiled before consumption with consistency. Overall, there was a strong desire amongst parents in Miguel Chiriap

to have knowledge of and access to a water treatment method that provided more practicality in order to protect their families from the risks of contaminated water.

In order to address these concerns amongst parents in Miguel Chiriap, an informational workshop was organized in order to introduce a new method that emphasized the practicality in the water treatment process but did not replace the effectiveness of water boiling. This workshop also addressed misconceptions surrounding water contamination and the water treatment process in order to ensure parents are using proper sanitation methods. The workshop was centered around teaching parents in Miguel Chiriap how to create and use a homemade Slow Sand Water Filter in their own homes. The workshop included six parents of Miguel Chiriap who had also been interviewed during the data collection process. A post-workshop discussion engaged these parents regarding their interest in and satisfaction with the information they learned during the workshop. 100% of participants indicated that they learned new information during the workshop and that they would implement the usage of a Slow Sand Water Filter. 100% of participants also noted that, if they were to collect the proper materials for construction of the filter, the Slow Sand Water Filter seemed like a more practical method than boiling water.

Overall, it was clear that parents in Miguel Chiriap are eager to treat their water but desire a method that is more practical for their daily lives. Water boiling has often been encouraged by local clinicians and medical professionals to be the main and only method for water treatment amongst families in Shuar communities. The effectiveness of the method is present in boiling, but the practicality is lacking, and the element of practicality seemed to be the motivating factor for water treatment in Miguel Chiriap. With

more attention to methods that meet both the effectiveness and the practicality of the water treatment process, Miguel Chiriap and Indigenous communities alike can see a decrease in diarrheal disease and improved health overall.

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ABOUT THE AUTHOR

Zoe Sheppard is a senior at St. John's University studying Environmental Studies with double minors in Social Justice and International Studies. Throughout her involvement with the Ozanam Scholars Program, Zoe has grown a passion for issues of environmental justice and Indigenous health. Her interests also include Fair Trade advocacy as she has been involved with the Fair Trade Committee at St. John's University. Zoe plans to pursue research and advocacy in environmental justice throughout her career.