Thesis on

A survey on *Salmonella typhi* Bacteria: its Implications, Current Situation, Preventions and Control Efforts

[*In the partial fulfillment of the requirements for the degree of Masters of Pharmacy]*

Submitted To

The Department of Pharmacy,

Faculty of Allied Health Sciences,

Daffodil International University

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APPROVAL

This thesis paper, **"A survey on *Salmonella typhi* Bacteria: its Implications, Current Situation, Preventions and Control Efforts",** submitted to the Department of Pharmacy, Faculty of Allied Health Sciences, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Masters of Pharmacy and approved as to its style and contents.

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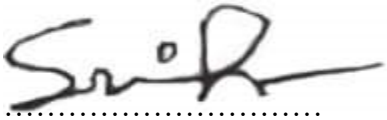
DECLARATION

I hereby declare that this thesis report, **"A survey on *Salmonella typhi* Bacteria: its Implications, Current Situation, Preventions and Control Efforts",** is done by me under the supervision Dr. Sharifa Sultana Associate Professor and Associate Head, Department of Pharmacy Faculty of Allied Health Sciences Daffodil International University. I am declaring that this thesis is my original work. I also declare that neither this thesis nor any part therefore has been submitted elsewhere for the award of master's degree.

Supervised by



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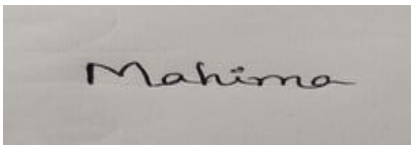

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Dedication……

My Parents

The persons who always encourage me in every sphere of my life.

Abstract

Salmonella typhi, the causative agent of typhoid fever, continues to pose a significant global health threat, particularly in regions with inadequate sanitation and limited access to clean water. This comprehensive survey explores the implications of *Salmonella typhi* infections, shedding light on the current situation, preventive measures, and ongoing control efforts. The implications of *Salmonella typhi* infections extend beyond the immediate health impact, encompassing economic burdens, reduced workforce productivity, and strain on healthcare systems. According to the survey, most of the responders replied that they have been very familiar with *Salmonella typhi* infection. In this investigation most of the responders (77%) replied that they have been affected Typhoid. 53% response that they have been suffered high fever that is becoming severe and constant. Also 17% participant's response that they have been suffered abdominal pain and 20% have been suffered higher and severe diarrhea. According to the survey, most of the participants (57%) replied that they have been taken medicine without doctor prescribing. According to the survey, most of the responders (78%) replied that they haven't aware about complication of *Salmonella typhi.* In this investigation most of the responders (60%) replied that they have been known Typhoid is a contagious disease. 37% responders replied that they have been taken preventive measure as washing hands regularly, 25% replied taken safe food handling practices, 20% replied that they have been taken vaccination and also 18% taken steps as avoiding raw or undercooked foods. 35% responders said Typhoid fever may be gets worse like Pneumonia and anemia, 22% typhoid intestinal perforation (TIP), 18% gastrointestinal hemorrhage & 15% hepatitis. The survey discusses various vaccination strategies, hygiene practices, and public awareness campaigns that have proven effective in reducing the incidence of typhoid fever. By understanding the implications and addressing the challenges, stakeholders can work collaboratively to reduce the burden of typhoid fever and improve public health outcomes worldwide.

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Chapter 1
Introduction

1. Introduction

Salmonella typhi, a pathogenic bacterium responsible for causing the debilitating and potentially life-threatening disease known as typhoid fever, continues to pose a significant global health challenge. With a long-standing history of affecting human populations worldwide, this bacterium has been a persistent threat, particularly in regions with inadequate sanitation and limited access to clean water. Typhoid fever remains a major public health concern due to its widespread prevalence, associated morbidity, and the potential for outbreaks [1]. The purpose of this investigation is to thoroughly investigate the consequences of *Salmonella typhi*, providing information on the disease's present state, preventative measures, and ongoing efforts to stop its propagation. Comprehending the complexities of this bacterial illness is crucial in order to formulate efficacious methods aimed at alleviating its influence on public health. Due to the bacteria's capacity to proliferate in human hosts and its tendency to spread through contamination of water and food sources, environmental and socioeconomic variables that contribute to its recurrence must be addressed [2]. As we delve into the intricate details of *Salmonella typhi*, we will examine the global prevalence of typhoid fever, identifying regions with higher susceptibility and exploring the socio-economic determinants that exacerbate the risk of outbreaks. Furthermore, this survey will scrutinize the latest advancements in diagnostics, treatment modalities, and vaccine development for *Salmonella typhi*, aiming to provide a comprehensive overview of the tools available to combat its spread. Emphasizing the significance of a multi-faceted approach, we will explore the role of public health interventions, sanitation improvements, and community engagement in breaking the transmission cycle of this infectious agent [3]. The survey on *Salmonella typhi* bacteria serves as a critical resource for researchers, healthcare professionals, and policymakers alike. By examining the current state of affairs, preventative measures, and ongoing control efforts, we aim to contribute to the collective knowledge necessary for devising comprehensive strategies to combat the persistent threat posed by Salmonella Typhi and mitigate the impact of typhoid fever on global public health [4].

Figure 1: Salmonella Typhi

1.1 History of *Salmonella typhi* infection in the world

Typhoid fever in humans is caused by the *Salmonella typhi* bacterium. The systemic infection known as typhoid fever is marked by a protracted and occasionally serious illness [5]. The following is a synopsis of Salmonella Typhi infections:

- **Identification of Typhoid Fever (19th Century):**

Typhoid fever has likely been present throughout human history, but the identification and understanding of the disease began in the 19th century. In the mid-1800s, physicians like Pierre-Charles-Alexandre Louis and William Budd made observations related to typhoid fever, but it was not until later that the bacterial cause was identified [6].

- **Identification of *Salmonella typhi* (1880s):**

In the late 19th century, bacteriologists such as Karl Joseph Eberth and Georg Theodor August Gaffky identified the bacterium *Salmonella typhi* as the causative agent of typhoid fever [7].

- **Mary Mallon (Early 20th Century):**

Mary Mallon, also known as "Typhoid Mary," gained notoriety in the early 20th century. She was an asymptomatic carrier of *Salmonella typhi* and unwittingly spread the disease to multiple people while working as a cook in the United States [8].

- **Improvements in Sanitation (20th Century):**

The understanding of the transmission of typhoid fever led to improvements in sanitation and public health measures. The development of sewage systems, water treatment, and food safety practices helped reduce the incidence of typhoid fever in many parts of the world [9].

- **Vaccination and Antibiotics (20th Century):**

The development of a typhoid vaccine in the early 20th century contributed to the control of the disease. Antibiotics such as chloramphenicol, ampicillin, and later ciprofloxacin became important in treating typhoid fever cases [10].

- **Global Distribution and Endemic Areas:**

Typhoid fever remains a significant health concern in many developing countries, especially in regions with inadequate sanitation and access to clean water. Travelers to endemic areas are at risk of contracting the disease, and vaccination is often recommended for those planning to visit such regions [11].

- **Current Challenges (21st Century):**

Despite progress, typhoid fever remains a global health issue, and drug-resistant strains of Salmonella Typhi have emerged, posing challenges to treatment [12].

- **Preventive Measures and Global Efforts:**

Ongoing efforts involve improving sanitation, access to clean water, and vaccination campaigns to reduce the burden of typhoid fever [13].

1.2 Pathogenesis of Typhoid fever by Salmonella Typhi

The bacterium Salmonella enteric serotype Typhi is the source of typhoid fever. An outline of the typhoid fever pathogenesis is provided below:

Transmission:

Typhoid fever is usually transmitted through the ingestion of food or water contaminated with the feces of an infected person. Poor sanitation and hygiene practices contribute to the spread of the disease [14].

Invasion of the Intestinal Tract:

After ingestion, the bacteria move to the small intestine, where they invade the intestinal mucosa. The bacteria can penetrate the lining of the intestines and enter the bloodstream. This phase is crucial for the systemic spread of the infection [15].

Systemic Spread:

Once in the bloodstream, *Salmonella typhi* is disseminated throughout the body. The bacteria can be carried to various organs and tissues, leading to systemic infection. The liver, spleen, and bone marrow are commonly affected [16].

Multiplication and Symptoms:

The bacteria multiply within the organs, causing symptoms such as high fever, headache, weakness, abdominal pain, and an enlarged spleen. The immune system responds to the infection, and symptoms often become more severe over time [17].

Immune Response:

The body's immune system responds by producing antibodies to fight the *Salmonella typhi* infection. However, the bacteria can evade the immune response to some extent, leading to a prolonged and persistent infection [18].

Typhoid Toxins:

The bacteria produce toxins that contribute to the severity of symptoms. These toxins can affect various organs and tissues, leading to complications such as intestinal perforation, gastrointestinal bleeding, and other serious conditions [19].

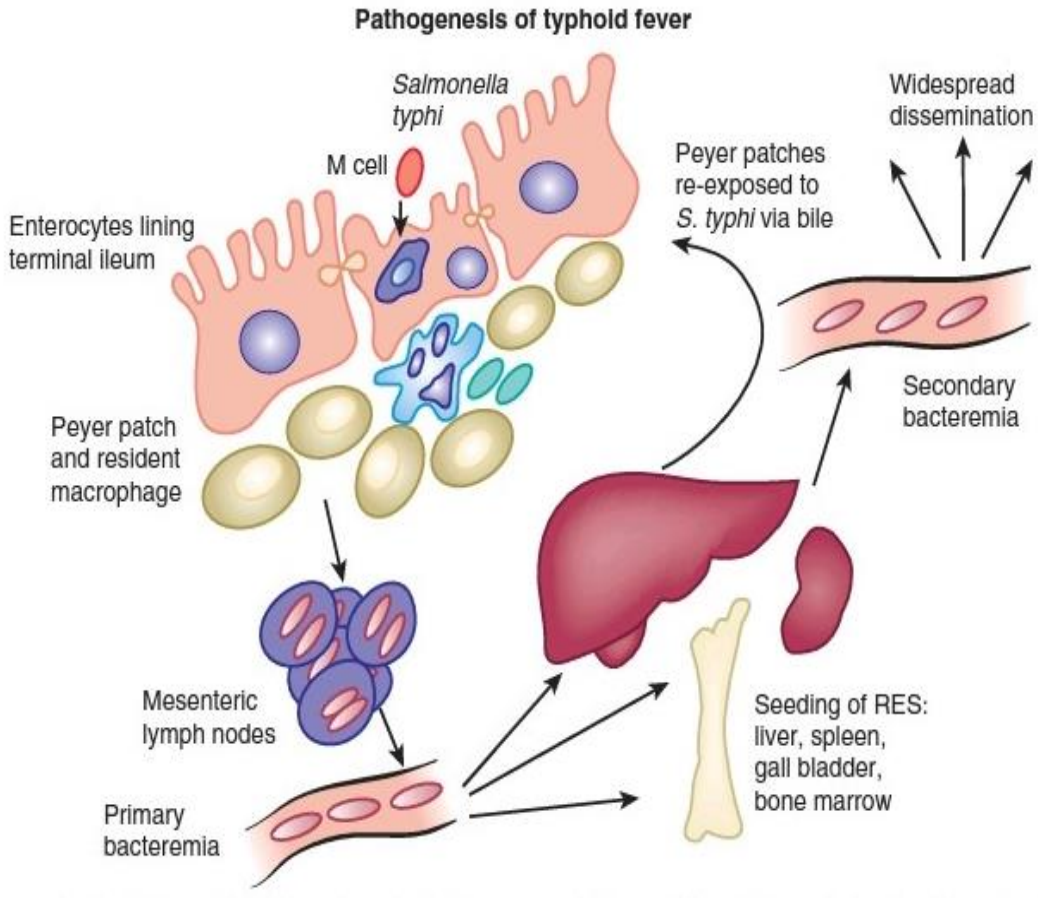

Figure 2: Pathogenesis of Typhoid fever

1.3 Typhoid fever vaccination

The immunization against typhoid fever serves as a prophylactic towards the bacterial disease typhoid, which is brought on by *Salmonella typhi*. The virus is typically spread via tainted water or food. In addition to causing high fever and other indications like headaches and abdominal discomfort, typhoid fever can be a dangerous sickness that could be fatal if antibiotics are not taken quickly enough [20].

There are two main types of typhoid fever vaccines:

Injectable Typhoid Vaccine (Vi Capsular Polysaccharide Vaccine): This vaccine is administered as a single injection, usually in the arm. It provides protection against typhoid fever for about two years. A booster dose is recommended every two years for individuals at continued risk [21].

Oral Typhoid Vaccine (Live Attenuated Ty21a): This vaccine is taken orally in the form of capsules. It is usually administered in a series of four capsules taken every other day. The oral vaccine provides protection for about five years. Booster doses are recommended every five years for those who remain at risk [22].

The choice of vaccine may depend on factors such as age, health status, travel plans, and the individual's preference. It's important to note that these vaccines do not provide 100% protection, so travelers should still be cautious about food and water hygiene when in areas where typhoid is endemic [23].

1.4 Diagnosis and Management of Typhoid Fever

- **Diagnosis:**

Clinical Evaluation:

Typhoid fever symptoms can be non-specific and similar to other febrile illnesses. Common symptoms include fever, headache, abdominal pain, and malaise. A thorough medical history and physical examination are essential for initial assessment [24].

Laboratory Tests:

Blood Culture: This is the most reliable method for confirming the diagnosis. Blood samples are collected and cultured to detect the presence of the Salmonella Typhi bacteria [25].

Stool Culture: In some cases, a stool sample may be collected to check for the bacteria, as the pathogen can also be present in the stool [27].

Other Tests:

Serologic Tests: These blood tests detect antibodies against the Salmonella Typhi bacteria. They may be used to support the diagnosis [28].

- **Management:**

Antibiotic Therapy:

Antibiotics are the primary treatment for typhoid fever. Commonly used antibiotics include ciprofloxacin, levofloxacin, and azithromycin. The choice of antibiotic may depend on the local patterns of antibiotic resistance [29].

Supportive Care:

Adequate hydration: Patients with typhoid fever may experience dehydration due to fever and gastrointestinal symptoms. Oral rehydration solutions or intravenous fluids may be administered [30].

Fever and pain management: Acetaminophen may be used to control fever and reduce pain.

Isolation and Hygiene:

Patients with typhoid fever should practice good hygiene to prevent the spread of the bacteria to others. Isolation precautions may be necessary, especially in healthcare settings [31].

Vaccination:

Typhoid vaccines are available and can be used for prevention in individuals traveling to areas where typhoid fever is endemic [32].

Monitoring:

Regular monitoring of vital signs, fluid balance, and laboratory parameters is essential for assessing the patient's response to treatment [33].

1.5 Antibiotic resistance in typhoid fever

Concern over antibiotic resistance in typhoid fever, which is brought on by the Salmonella enterica serotype Typhi bacteria, is on the rise worldwide. The consumption of tainted food or water might result in the potentially fatal sickness known as typhoid fever. Therapy for Salmonella Typhi has become increasingly difficult due to the advent of antibiotic-resistant forms of the infection. Typhoid fever is frequently treated with fluoroquinolones (like ciprofloxacin) and third-generation cephalosporins (like ceftriaxone). But over time, Salmonella Typhi bacteria have become resistant to these medications [34].

Several mechanisms contribute to antibiotic resistance in typhoid:

Plasmid-mediated resistance: Resistance genes can be carried on plasmids, which are small, circular DNA molecules separate from the bacterial chromosome. These plasmids can be easily transferred between bacteria, facilitating the spread of resistance.

Point mutations: Resistance can also occur due to mutations in the bacterial genome, affecting the target sites of antibiotics. For example, mutations in the genes that encode DNA gyrase or topoisomerase IV can confer resistance to fluoroquinolones [35].

Efflux pumps: Bacteria may develop efflux pumps that actively remove antibiotics from the bacterial cell, reducing the concentration of the drug inside the bacterium and rendering it ineffective [36].

Biofilm formation: Salmonella Typhi can form biofilms, which are communities of bacteria embedded in a protective matrix. Biofilm formation can reduce the effectiveness of antibiotics and contribute to persistent infections [37].

The emergence of multidrug-resistant (MDR) and extensively drug-resistant (XDR) strains of *Salmonella typhi* has limited treatment options. This has led to increased reliance on alternative antibiotics, such as azithromycin and carbapenems. However, even these options may face challenges as resistance continues to evolve [38].

To address the problem of antibiotic resistance in typhoid fever, a comprehensive approach is needed, including:

Improving sanitation and hygiene: Typhoid fever is often associated with poor sanitation and contaminated water. Improving these conditions can help prevent the spread of the disease [39].

Vaccination: The use of typhoid vaccines can help prevent infections and reduce the reliance on antibiotics for treatment.

Surveillance and monitoring: Regular surveillance of antibiotic resistance patterns is crucial for identifying emerging resistant strains and adjusting treatment strategies accordingly [40].

Promoting responsible antibiotic use: To slow down the development of resistance, it is essential to promote the judicious use of antibiotics, avoid unnecessary prescriptions, and complete the full course of treatment when antibiotics are necessary.

The ongoing efforts to address antibiotic resistance in typhoid fever involve a combination of public health interventions, research into new treatment options, and global collaboration to monitor and control the spread of resistant strains [41].

Chapter 2
Literature Review

2.1 *Salmonella typhi*: from a Human Pathogen to a Vaccine Vector

Salmonella typhi is a significant pathogen that enters cells. Out all the 2,300+ closely associated Salmonella serovars that have been identified, S. Typhi is the only variant that is harmful only to humans, causing typhoid or enteric fever. The pathogen has existed for a long time, and numerous studies have been conducted in an attempt to combat it. Numerous studies have been conducted on the molecular and biologic characteristics of S. Typhi, as well as the host variables and immunological responses involved in Salmonella penetration. Most significantly, two vaccines have been emerged: Ty21a and Vi polysaccharide. Still, a long way to go, as the outcomes demonstrate. It has also been demonstrated that the small number of antibiotics that are now accessible have developed multi-drug resistance. This has shown promise since it can activate the immune system in reaction to the pathogen's antigen as well as the Salmonella bacterium. This overview seeks to illustrate some of the significant advancements made in the battle toward the illness, from the discovery that S. Typhi was a bacterium that caused typhoid fever to the application of Salmonella as a vaccine vector [42].

2.2 Problem pathogens: extra-intestinal complications of Salmonella enterica serotype Typhi infection

The global prevalence of typhoid fever, which is brought about by Salmonella enterica serotype Typhi (S Typhi), is believed to be between 12 and 33 million occurrences. The extent of the digested S Typhi inoculum, the strain's virulence, the host's immune system, previous contact, and local protective variables all play a role in the pathogenesis of this illness. A S Typhi infection can result in a wide range of extra-intestinal problems, which includes as damage to the pulmonary system (1-66%), central nervous system (1-35%), cardiovascular system (1-4%), bone and joints (1%), hepatobiliary department (1-26%), genitourinary system (<1%), and others. Typhoid fever and associated consequences have been treated more often with fluoroquinolones and third-generation cephalosporins in response to a rise in multidrug-resistant S Typhi. We go over the pathophysiology, clinical signs, epidemiology, and management of extra-intestinal S Typhi infections [43].

2.3 Typhoid fever: pathogenesis and disease

An infectious disease with a worldwide distribution is typhoid fever. The pathophysiology of typhoid fever and Salmonella typhimurium infections in mice are well documented, whereas human cell lines and this serovar's interactions with them in vitro are the subject of very less research. The following topics are the focus of this review: diffusion to systemic regions, survivability and replication inside host cells, and adhesion to and invasion of gut epithelial cells. Furthermore, we make an effort to contextualize recent salmonella findings in relation to typhoid disease [44].

Chapter 3

Purpose of the study

3.1 Purpose of the study

This study's main goal is to thoroughly examine all of the aspects of the *Salmonella typhi* bacterium in order to shed more light on the disease's consequences, the state of affairs at the moment, and future directions for control and prevention. The project intends to provide important new information about *Salmonella typhi*, the pathogenic bacteria that causes typhoid fever, and to guide initiatives aimed at improving public health to lessen its effects.

- **Understanding the Implications:**

Explore the medical, social, and economic implications of *Salmonella typhi* infections on individuals and communities. Examine the impact of typhoid fever on public health systems, including the burden on healthcare infrastructure and resources.

- **Current Situation Analysis:**

Assess the global prevalence and distribution of *Salmonella typhi*, identifying regions or populations most affected by the bacterium. Investigate the recent trends and patterns in *Salmonella typhi* infections, including factors such as antibiotic resistance and emerging strains.

- **Prevention Strategies:**

Evaluate the effectiveness of current preventive measures, including vaccination programs, sanitation practices, and public awareness campaigns. Identify gaps in existing prevention strategies and propose improvements or novel approaches for more robust prevention.

- **Control Efforts:**

Examine ongoing efforts in the control of *Salmonella typhi*, including surveillance systems, outbreak response mechanisms, and international collaborations. Assess the challenges faced in controlling the spread of Salmonella Typhi and propose strategies for enhancing control measures.

- **Public Health Recommendations:**

Provide evidence-based recommendations for policymakers, healthcare professionals, and public health authorities to strengthen prevention and control measures. Highlight the

importance of interdisciplinary collaboration between healthcare, sanitation, and education sectors in combating *Salmonella typhi* infections.

- **Future Research Directions:**

Propose avenues for further research to enhance our understanding of *Salmonella typhi*, such as genomic studies, host-pathogen interactions, and innovative diagnostic methods. Encourage continued surveillance and research efforts to stay ahead of evolving bacterial strains and emerging challenges.

By conducting this extensive survey, the study hopes to provide insightful data that will drive efforts in public health, policy development, and investigation projects targeted at lowering the incidence and consequences of Salmonella Typhi infections worldwide.

Chapter 4
Methodology

4. Methodology

To collect information from an accurate representation of the people in Dhaka, Bangladesh, use a cross-sectional survey design.

- I have started work for this survey in October 2023.

4.1 Data Collection:

- Develop a structured questionnaire based on validated scales and existing literature related to *Salmonella typhi.*
- Translate the questionnaire into Bengali for better understanding by the local population. Train a team of data collectors on the questionnaire and ethical considerations.
- Conduct face-to-face interviews, phone interviews, or online surveys/offline survey, depending on the accessibility of the respondents. Ensure informed consent and data confidentiality.
- A significant amount of pertinent information has been gathered by reviewing several linked article papers from several websites, including PubMed, Research Gate, and Google Scholar.

4.2 Data Variables:

- Collect demographic information, including age, gender, educational background, occupation, and residence.
- Gather information related to *Salmonella typhi*, such as the presence of symptoms, family history, triggers, severity, and healthcare utilization.
- Explore lifestyle factors, including smoking habits, dietary patterns, and physical activity.
- Assess environmental factors, such as air quality, housing conditions, and proximity to potential allergens.

4.3 Sample size

The test had 13 short-answer questions and took roughly four to five minutes to finish.

- I have tried my best to collect all data from different profession people for gathering different types of information.
- The examination is led by a questionnaires-oriented survey, around 200 populations was being responded for these assessments.

4.4 Data analysis strategy

The methodical utilization of logical and/or statistical tools for characterizing and illuminating, compressing and reiterating and assessing data is known as data analysis. Utilize suitable statistical software to examine the gathered information. For a summary of data on demographics and frequency, use descriptive statistics.

Chapter 5

Results & discussion

5.1 Age of Responders

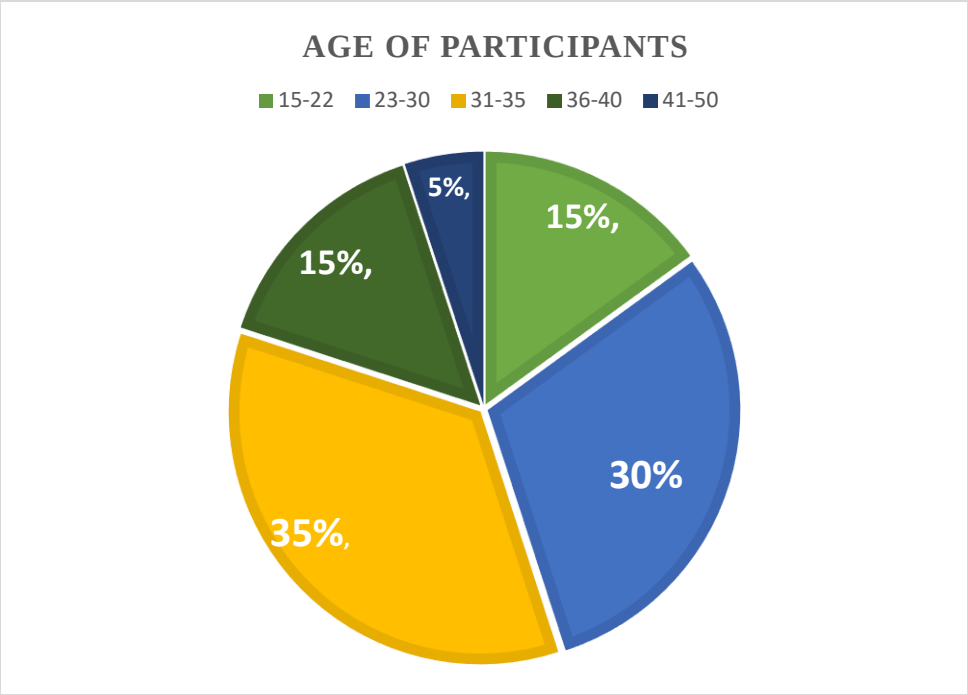

Figure 3: Age of Responders

Discussion: According to the survey, 35% responders are 31-35 age, 30% responders are 23-30 age. The majority of individuals providing responses seem to be 23-35 years.

5.2 Gender of Participants

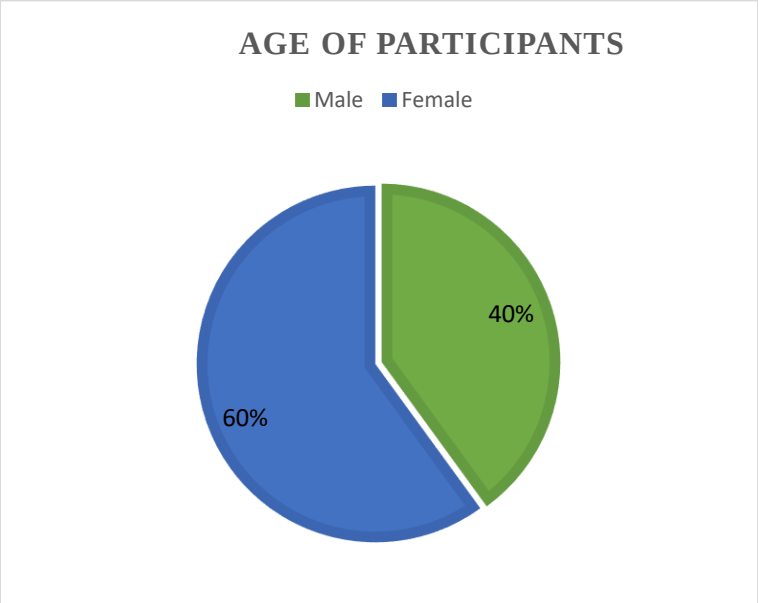

Figure 4: Gender of Participants

Discussion: The diverse gender representation in this survey, with 40% male and 60% female participants.

5.3 Professional Status of Responders

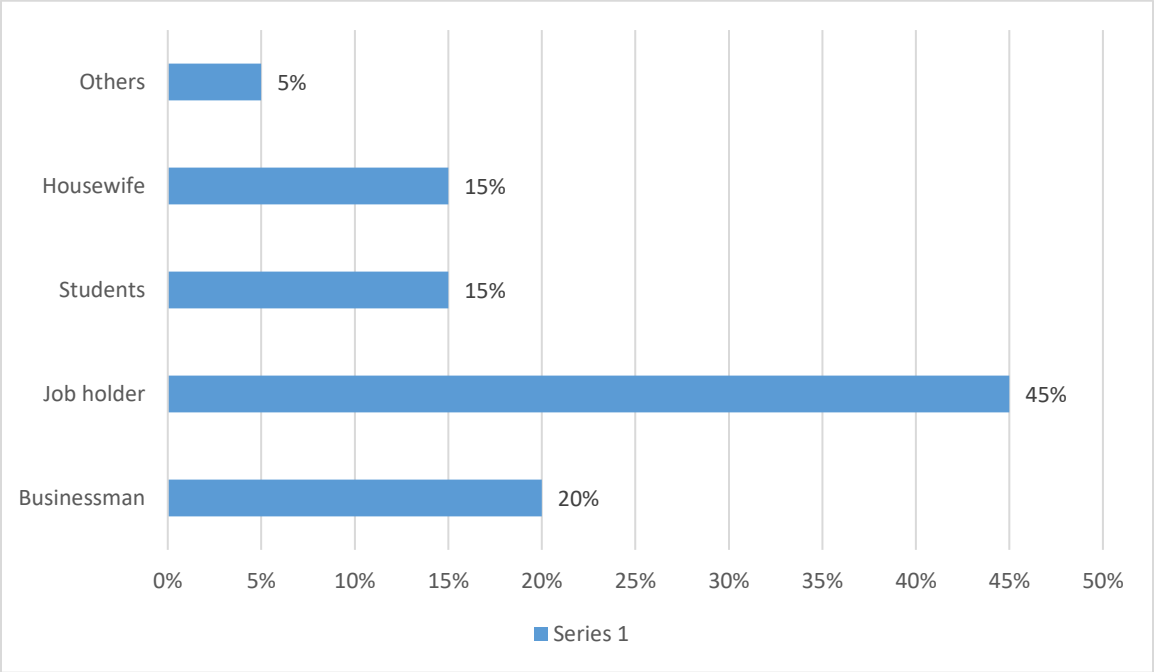

Figure 5: Professional Status of Responders

Discussion: Different professional personnel has been chosen for this survey. According to figure 5 most of the participants are Job holder (45%), also 20% are businessman.

5.4 Familiar with *Salmonella typhi* bacteria

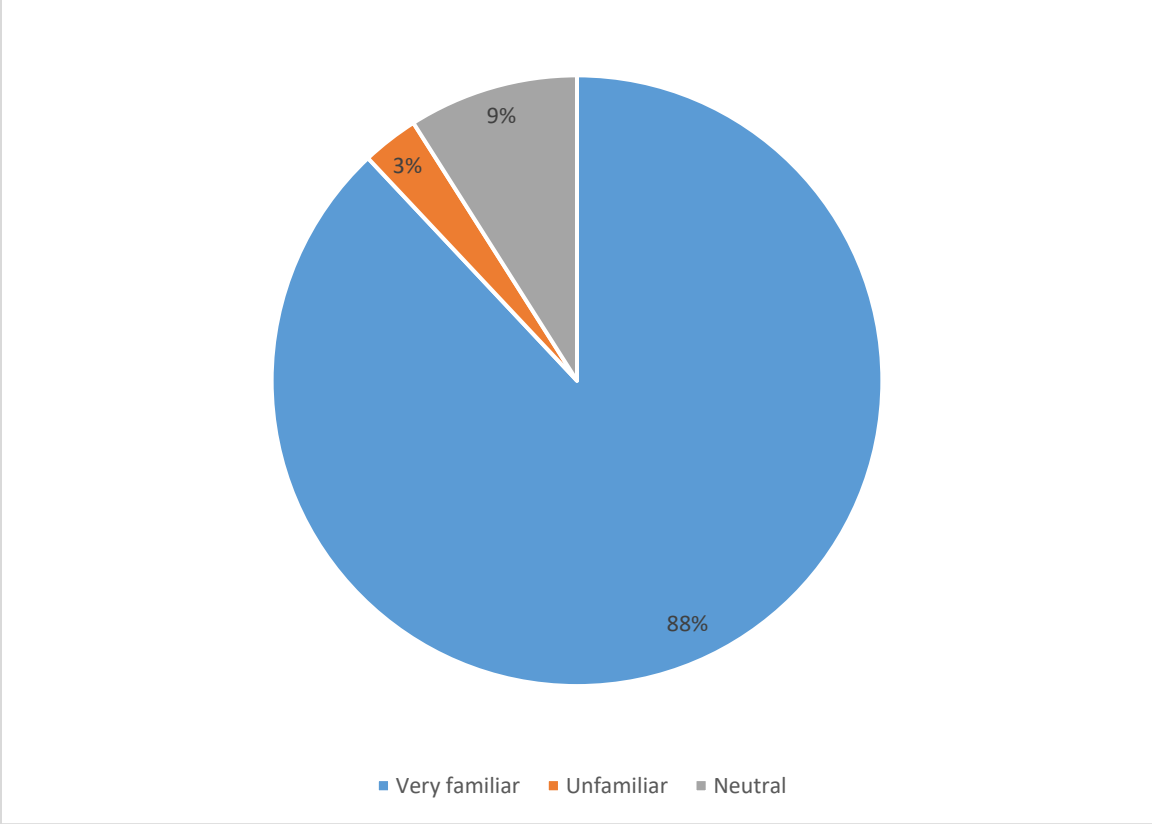

Figure 6: Familiar with *Salmonella typhi* bacteria

Discussion: Typhoid fever is caused by the gram-negative Salmonella enterica Typhi bacterium, which has plagued impoverished countries for many years. According to the survey, most of the responders have been replied they have very familiar with Salmonella Typhi infection.

5.5 Affected ratio of Typhoid fever

Q: Have you ever been affected by Salmonella Typhi or Typhoid fever?

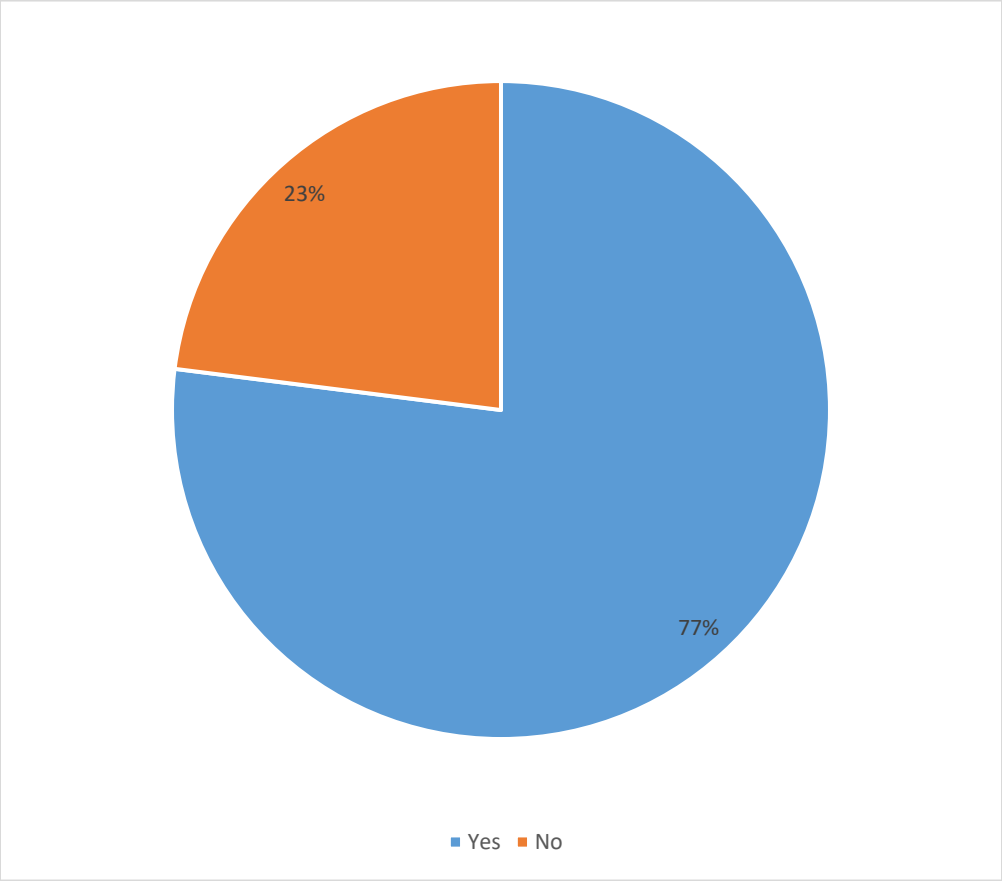

Figure 7: Affected ratio of Typhoid fever

Discussion: *Salmonella typhi*, a bacterium linked to those that cause salmonella food poisoning, is the cause of typhoid. In this investigation most of the responders (77%) have been affected Typhoid.

5.6 If yes, which type of symptoms have you suffered?

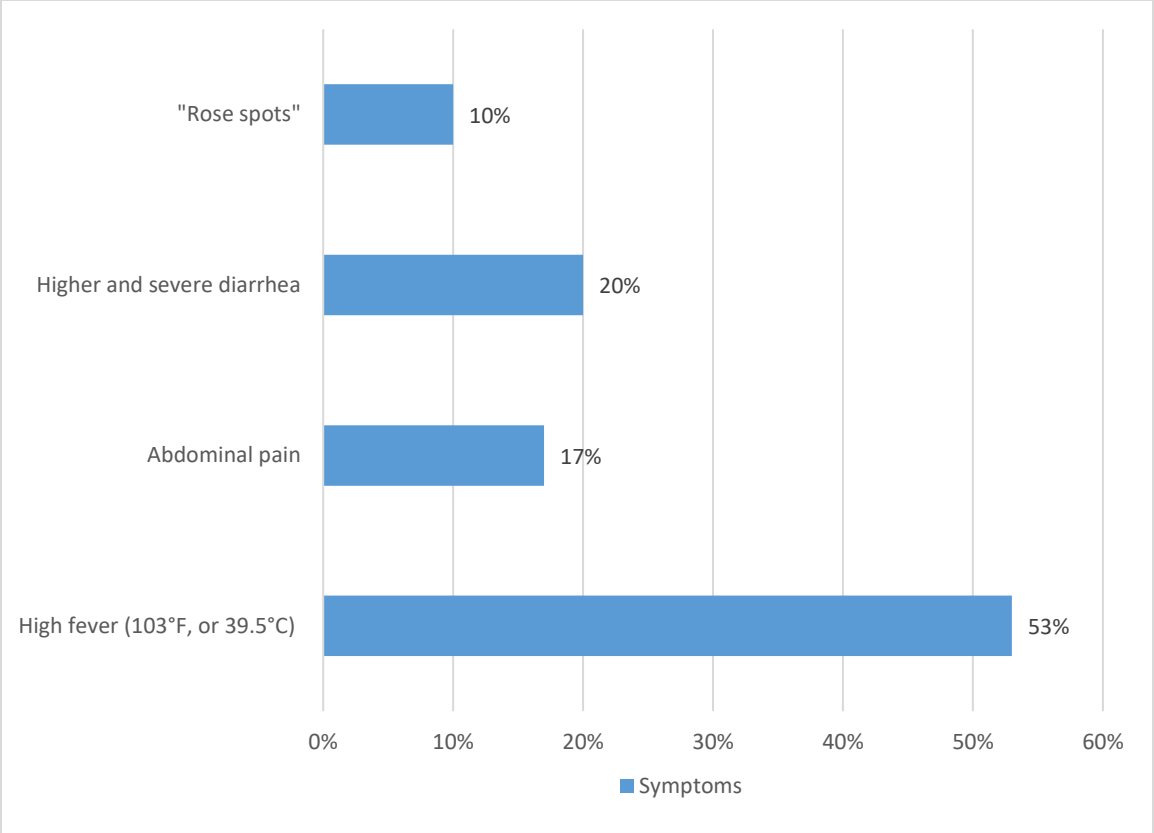

Figure 8: Symptoms of Typhoid

Discussion: Among the affected patients, they said that they have been suffered different symptoms. Among them 53% response that they have been suffered high fever that is becoming severe and constant. Also 17% participant's response that they have been suffered abdominal pain and 20% have been suffered higher and severe diarrhea.

5.7 Awareness about complication of *Salmonella typhi* infection

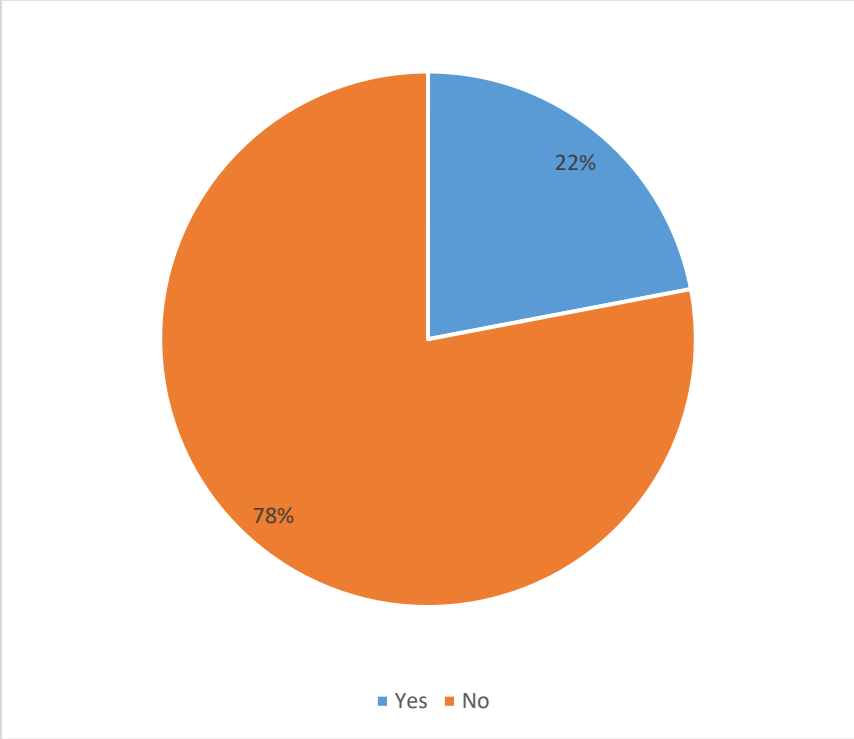

Figure 9: Awareness about complication of *Salmonella typhi* infection

Discussion: Internal bleeding in the digestive tract and typhoid fever are the two most frequent consequences. Splintering (perforation) of a bowel or digestive tract, which allows the infection to propagate to neighboring tissues. According to the survey, most of the responders (78%) have been said they haven't aware about complication of *Salmonella typhi*.

5.8 Taken medicine

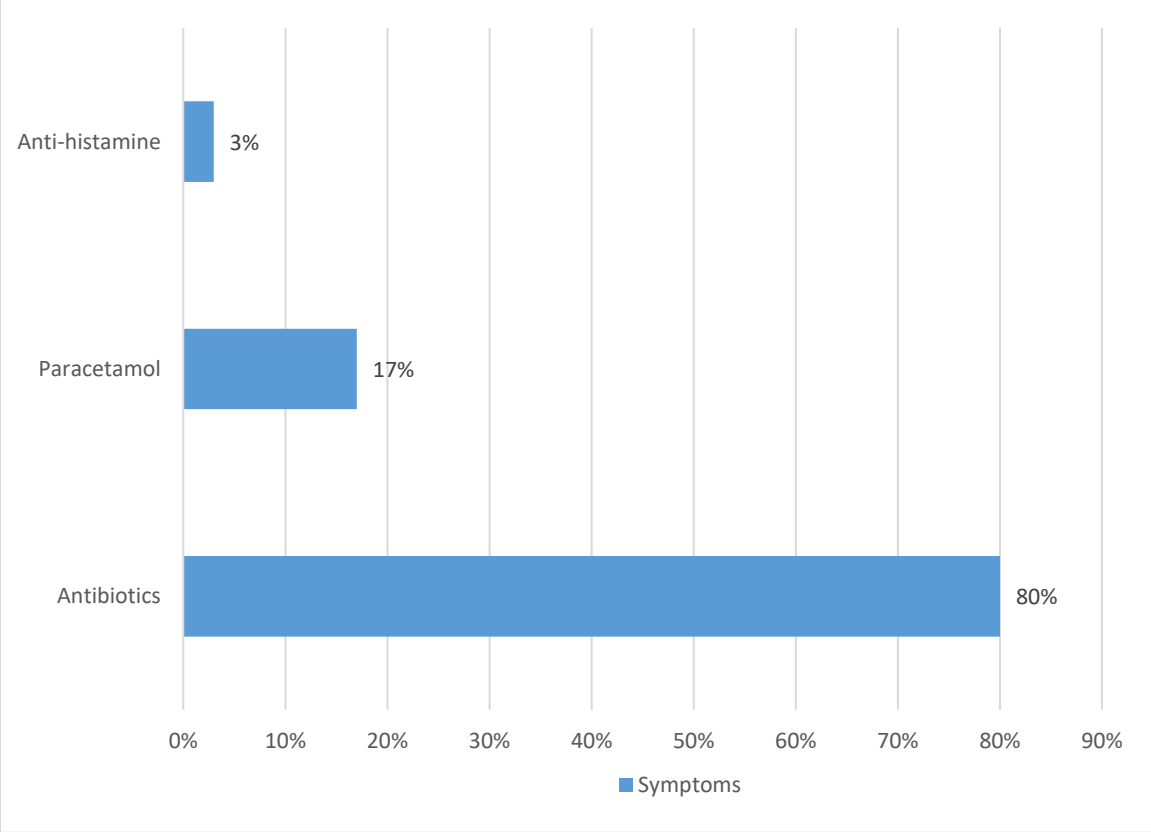

Figure 10: Taken medicine

Discussion: Since typhoid is a bacterial disease that's why antibiotic is the first line treatment. According to the survey, majority of the participants (80%) responded they have been taken antibiotics for relieving typhoid.

5.9 Taken medicine without doctor suggestion

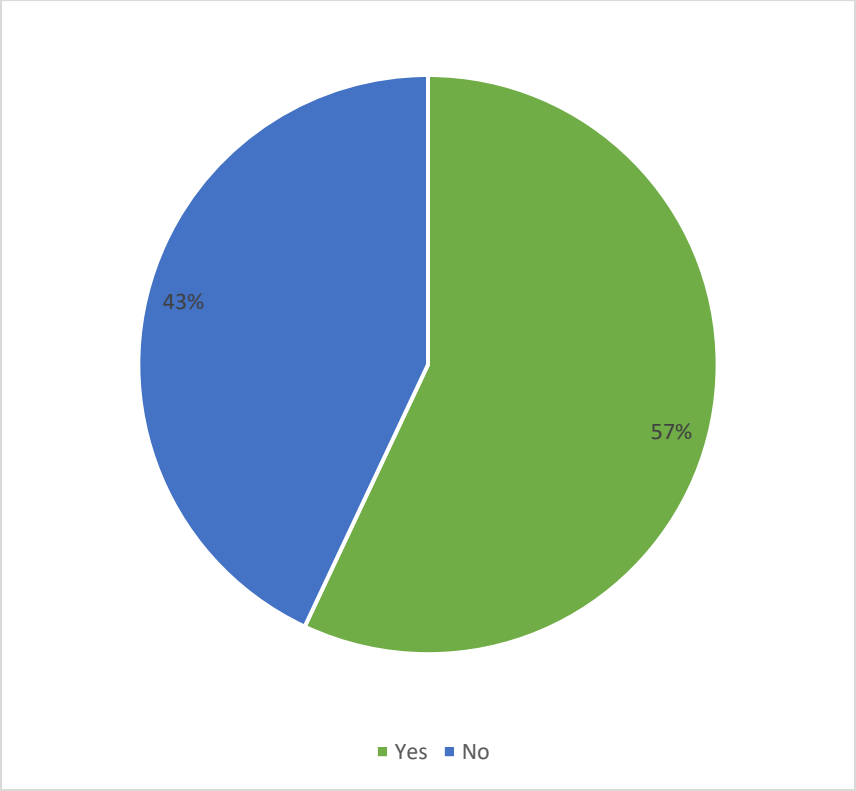

Figure 11: Taken medicine without doctor suggestion

Discussion: It might be risky to take medication without first seeing a doctor because doing so can result in major health issues or even death. The possibility that medicine won't be beneficial for the ailment being addressed is one of the most serious dangers associated with consuming it without first seeing a doctor. Most of the people haven't aware about non-prescribed medication. According to the survey, most of the participants (57%) replied they have been taken medicine without doctor prescribing.

5.10 Typhoid is a contagious disease

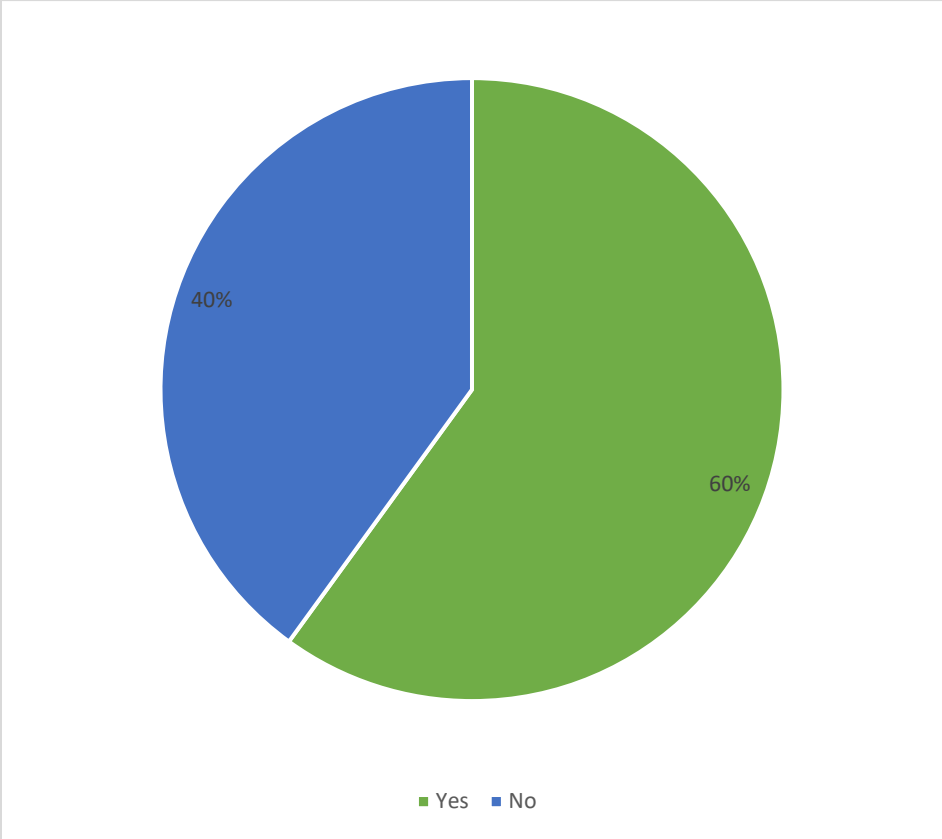

Figure 12: Typhoid is a contagious disease

Discussion: Typhoid fever is a contagious disease caused by the bacterium *Salmonella typhi*. It is typically spread through the ingestion of food or water contaminated with the feces of an infected person. People with typhoid fever can shed the bacteria in their stool and, to a lesser extent, in their urine. Contamination can occur when someone handling food or water has poor hygiene and has come into contact with the bacteria. In addition, individuals who are carriers of the bacteria but do not show symptoms can also spread the disease to others. In this investigation most of the responders (60%) replied they have been known Typhoid is a contagious disease.

5.11 Preventive measure to avoiding *Salmonella typhi* infection

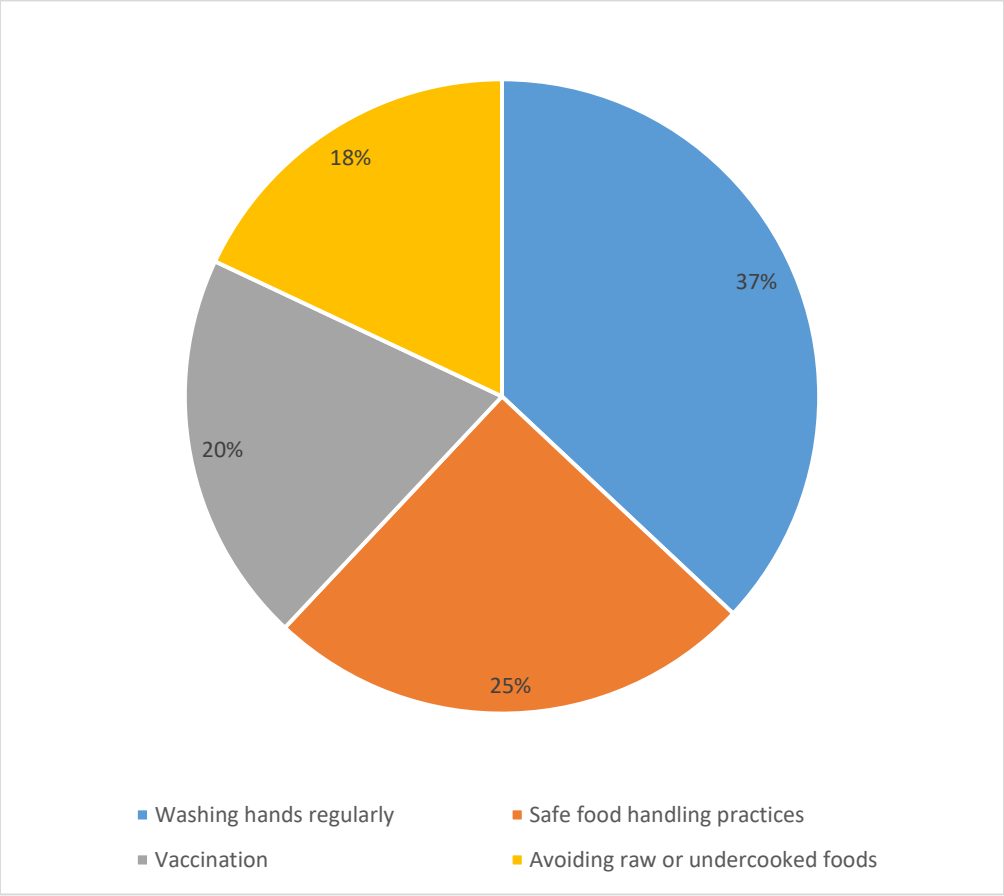

Figure 13: Preventive measure to avoiding *Salmonella typhi* infection

Discussion: Rather of treating an illness, preventative measures involve taking actions to avoid it from happening in the first place. According to the survey, 37% responders replied they have been taken preventive measure as washing hands regularly, 25% replied taken safe food handling practices, 20% replied they have been taken vaccination and also 18% taken steps as avoiding raw or undercooked foods.

5.12 Complication of Typhoid fever/*Salmonella typhi* infection

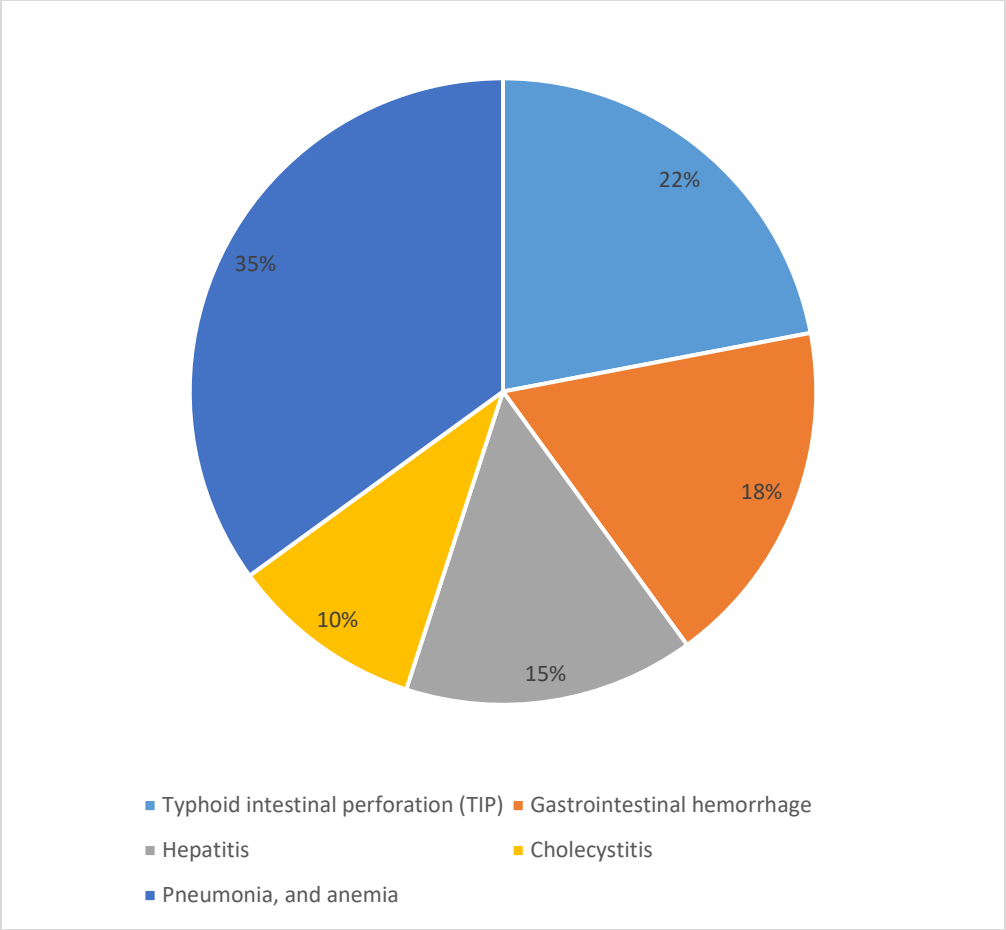

Figure 14: Complication of Typhoid fever/*Salmonella typhi* infection

Discussion: Typhoid fever problems often only occur in patients who were not treated promptly or who were not given the proper medications. According to the survey, 35% responders said Typhoid fever may be gets worse like Pneumonia and anemia, 22% typhoid intestinal perforation (TIP), 18% gastrointestinal hemorrhage & 15% hepatitis. Everybody should be aware about complication.

Chapter 6
Conclusion

6.1 Conclusion

In conclusion, the survey on *Salmonella typhi* bacteria has provided valuable insights into the implications, current situation, preventions, and control efforts surrounding this infectious agent. *Salmonella typhi* remains a significant public health concern, particularly in regions with inadequate sanitation and water hygiene practices. The implications of *Salmonella typhi* infection are far-reaching, affecting individuals and communities with symptoms ranging from mild gastroenteritis to severe, potentially life-threatening typhoid fever. The burden of the disease is particularly pronounced in developing regions, underscoring the need for targeted interventions and awareness campaigns. The current situation reveals persistent challenges in combating *Salmonella typhi*, including antibiotic resistance, limited access to clean water, and gaps in public health infrastructure. The emergence of drug-resistant strains emphasizes the importance of a multi-faceted approach to control and prevention. Preventive measures play a crucial role in mitigating the spread of *Salmonella typhi*. These include promoting hygiene practices, ensuring access to safe drinking water, and implementing vaccination programs. Vaccination, in particular, stands out as a key tool in reducing the incidence of typhoid fever, and efforts should be intensified to expand vaccine coverage, especially in high-risk areas. Additionally, there is a need for ongoing research to develop new vaccines, therapeutic strategies, and innovative approaches to improve water and sanitation infrastructure. According to the survey, most of the responders have been replied they have very familiar with Salmonella Typhi infection. In this investigation most of the responders (77%) have been affected Typhoid. 53% response that they have been suffered high fever that is becoming severe and constant. Also 17% participant's response that they have been suffered abdominal pain and 20% have been suffered higher and severe diarrhea. According to the survey, most of the participants (57%) replied they have been taken medicine without doctor prescribing. According to the survey, most of the responders (78%) have been said they haven't aware about complication of *Salmonella typhi*. In this investigation most of the responders (60%) replied they have been known Typhoid is a contagious disease. 37% responders replied they have been taken preventive measure as washing hands regularly, 25% replied taken safe food handling practices, 20% replied they have been taken vaccination and also 18%

taken steps as avoiding raw or undercooked foods. 35% responders said Typhoid fever may be gets worse like Pneumonia and anemia, 22% typhoid intestinal perforation (TIP), 18% gastrointestinal hemorrhage & 15% hepatitis. Control efforts must be comprehensive and collaborative, involving public health authorities, healthcare professionals, researchers, and communities. Surveillance systems should be strengthened to monitor the prevalence of *Salmonella typhi* and track antibiotic resistance patterns.

Chapter 7
Reference

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