SERO-EPIDEMIOLOGIAL STUDY ON TYPHOID FEVER IN KAILALI DISTRICT, FAR-WESTERN REGION OF NEPAL

(A HOSPITAL BASED STUDY)

A DISSERTATION SUBMITTED FOR THE PARTIAL FULFILLMENT OF THE MASTER'S DEGREE IN ZOOLOGY (Parasitology)

BY

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TO

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RECOMMENDATION LETTER

This is to certify that **Mr.Hari Singh Bohara** has successfully completed the dissertation work entitled "**Sero-epidemiological Study on Typhoid Fever in Kailali District, Far-Western Region of Nepal (A Hospital Based Study**)"as a partial fulfillment of Master's Degree of Science in Zoology with Parasitology as a special paper. His work is an original one and deserves to recommendation.

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CERTIFICATE OF APPROVAL

On the recommendation of **Dr. Ranjana Gupta**, this dissertation work of **Mr. Hari Singh Bohara** is approved for the examination and is submitted to the Tribhuvan University in partial fulfillment of the requirements for Masters Degree of Science in Zoology (Parasitology).

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The dissertation work submitted by **Mr. Hari Singh Bohara** entitled "**Sero-epidemiological Study on Typhoid Fever in Kailali District, Far-Western Region of Nepal (A Hospital Based Study**)" has been accepted as a partial fulfillment of Master's Degree in Zoology with Parasitology as a special paper.

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ABSTRACT

A Sero-epidemiological Study on Typhoid Fever in Kailali district was conducted between June 2005 and May 2006. During the study period, 936 blood samples from the suspected patients visiting Seti Zonal Hospital from various localities of Kailali district were collected and examined for the presence of *Salmonella* antibody to rule-out infection of Typhoid fever. A total of 936 serum samples tested by Widal test, the incidence of Typhoid fever was found to be 30.87%. The sex-wise incidence of Typhoid fever was found slightly more in males (31.02%) than in females (30.69%). The highest incidence of Typhoid fever was found in the age group 10-19 yrs (35.31%) while the least incidence of Typhoid fever was found in the age group 60-69 yrs (9.37%) and no case of Typhoid fever was recorded in the age group of 70 yrs and above.

The incidence rate of Typhoid fever in Kailali district was found 0.46 per thousand per year. The sex wise incidence rate of Typhoid fever in Kailali district was found slightly more in male (0.51/1000 /year) than in female (0.42/1000 /year). The case fatality rate due to Typhoid fever in Kailali district was not found.

Similarly, incidence of Typhoid fever was found to be the highest in the months of August (42.19%) and the least in the month of January (9.37%).

The questionnaire survey revealed that the predominant symptoms of Typhoid fever among 289 Typhoid patients were fever in 100% patients, intense headache in 84.43%, abdomen pain in 34.95%, diarrhoea and loose stool in 40.83%, vomiting and nausea in 29.76% and cough in 28.37% patients.

The questionnaire survey also revealed that most important risk factors for the transmission of Typhoid fever among community people are lack of awareness, unhygenic conditions of drinking water source, improper food consuming practice and environmental pollution etc.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOGRAPHS AND MAP

LIST OF ABBREVIATIONS

betn	Between
CFR	Case Fatality Rate
CFRL	Central Food Research Laboratory
DOTS	Directly Observed Treatment Short-course
EPI	Expanced Programme on Immunization
GIS	Geographical Information System
hrs.	Hours
Indiv.	Individual
IR	Incidence Rate
KAP	Knowledge, attitude and Practice
KMC	Kathmandu Metropolitan City
lab.	Laboratory
Microbiol	Microbiology
DM	Dhangadi Municipality
No.	Number
S.E.	South–East
S.N.	Serial Number
spp.	Species
SZH	Seti Zonal Hospatal
T.U.	Tribhuvan University
temp.	Temperature
WHO	World Health Organization
wt.	Weight
yrs.	Years
S. typhi	*Salmonella typhi*
S. paratyphi A	*Salmonella paratyphi* A
S. paratyphi B	*Salmonella paratyphi* B

GENERAL INTRODUCTION

Typhoid fever is public health important bacterial disease caused by *Salmonella* spp., which is commonly found in the intestine of man. It occurs at almost all parts of the world in all age and sex groups and in all seasons. World-wide, Typhoid fever affects about six million people with more than 600,000 deaths per year. Among these, 80% of cases and deaths are in Asia and most of others occur in Africa and Latin America (WHO, 1996).

Typhoid fever or Enteric fever is a foodborn or waterborn systemic disease still prevalent in regions with poor sanitation, where without therapy it causes death of 10% to 30% of those affected persons. Thus, it is thought to be a major and increasing problem of some developing countries where it affects the social and economic status of the country because it affects male and female, children and adults, young and healthy individuals equally (Schaechter *et al*., 1989).

Natural infection of Typhoid fever is by ingestion followed by penetration of bacteria through the intestinal mucosa. Generallly 10^7 to 10^9 organisms are necessary for the onset of Typhoid fever. The bacilli first invade and multiply in ileum as Payer's patch and in lymphoid nodules of large intestine and then enter into the blood stream and lead to systematic illness resulting various symptoms like malaise, chills, headache, abdominal discomfort and gradual elevation in temperature i.e. 30^0 C to 40^0C. Faeces and urine of cases and carriers are primary sources and contaminated water, food, fingers and flies are the secondary sources of infection of Typhoid fever. It is transmitted via the faecal-oral route or urine oral routes (Park, 2005).

Enteric fever continues to be one of the most common infectious diseases in Nepal and other developing countries. Enteric fever includes Typhoid and para

Typhoid fevers. So, Enteric fever is the term to describe the typhoid and paratyphoid group of fever. These infections i.e. Typhoid and paratyphoid fevers are caused by gram negative bacterium known as *Salmonella* spp. This bacterium is generally known as 'Typhoid Bacillus'. *Salmonella* spp can be detected by doing blood cultures in 75%-80% of patients during the first ten days of infection and about 30% of patients during the third week. The organism can be detected by doing serological test in 70% of the patients but sometimes it gives negative result as in immunosuppressed patients, in HIV infected patients etc. The organisms can be isolated from 40-50% of patients during the second week of infection and from about 80% of patients during the third week in faeces. In 25% of patients, *Salmonella* spp can be isolated in the urine in second week but usually urine culture is done on fourth week of infection for the isolation of *Salmonella* spp (Cheesebrough, 1984).

Enteric fever is most prevalent in the socio-economically deprived areas of the world. Spread of this disease is facilitated by poor environmental hygiene which is endemic in many tropical countries. Enteric fever is caused mainly by unhygenic food, contaminated water and polluted environment. Several hundreds of cases of enteric fever are reported annually in Britain. Over 62% of this disease is contracted to other countries like South-Asian and African countries. In Mexico, Latin America, Asia, Africa and the Middle East where the fatality rate is as high as 10% each year, this disease is still a serious health problem.

Typhoid fever occurs in all parts of the world, except cold regions where water supplies and sanitation are sub-standard. The disease is now not common in the developed countries where most of the cases that occur are either acquired abroad or imported by immigrants. In UK, Typhoid fever has been brought very close to eradication with approximately one case per 1,000,000 populations, which is perhaps

the lowest incidence of the Typhoid in the world. Typhoid fever continues to be unabated in the developing countries of Africa, Asia and Latin Amarica. (Park, 2005)

Typhoid and Paratyphoid fevers are endemic in the Indian sub-continent, South-east and Far-East Asia, the Middle-east Africa, Central and South-America. A low level of endemicity also exists for paraTyphoid B infections. In the Southern and Eastern part of Europe, enteric fevers occur almost exclusively as imported infections. Paratyphoid C is rare with occasional cases in Guyana and Eastern Europe (Park, 2005). Typhoid fever continues to be unabated in the developing countries of Africa, Asia and Latin America (WHO, 1973).

In Nepal, the information about typhoid disease is very limited and scanty. A survey of etiology of Typhoid fever and diagnosis of *Salmonella* spp is necessary in our community and geographical region in order to investigate the incidence of Typhoid fever. Hence, a survey study was carried on epidemiological study of Typhoid fever by typhoid positive blood samples examination of the patients visiting Seti Zonal Hospital, Kailali and by interviewing the patients and also conducting interview in a group of community people during June 2005- May 2006. The patients were randomly from all over the Kailali district of 2-80 years range and all kinds of socio-economic status.

II

TYPHOID FEVER AND ITS CAUSATIVE AGENT

- **Typhoid Fever**Typhoid fever or enteric fever is a febrile illness of prolonged duration marked by fever, delirium, persistent blood stream infection, enlargement of spleen, abdominal pain and a variety of systematic manifestations (Sleisenger and Fordtran, 1993). It is a continuous fever caused by bacillus-bacterium called *Samoella typhi*, commonly found in intestine of human beings. Typhoid fever got its name from typhus because it was so like this disease. The confusion between Typhoid and typhus fever was resolved only with the publication in 1850 of William Jenner's book on the 'Identity and Non-identity of Typhoid and Typhus fevers' (Cook, 1996). The term "Enteric fever" and Eberth disease have been applied both to Typhoid fever and collectively to Typhoid and paraTyphoid fevers.

Salmonella spp., the causative agent of Typhoid fever which is a large group of gram-negative bacilli belonging to the family Enterobacteriacae. Among various species, *Salmonella typhi* is the major cause of Typhoid fever. *Salmonella typhosa* was first described by Eberth in 1880 and isolated from a patient by Gaffky in 1884. In 1860, Dr. William Budd discovered that contamination of water with human excreta was responsible for the Typhoid fever.

- **Morphological characters of causative agent** (*Salmonella* spp.)

The genus *Salmonella* is a member of the family Enterobacteriacae having characters like rod-like shape, aerobic, catalase positive, oxidase negative, production of gas by carbohydrate breakdown etc. It is a gram-negative, non-sporing, facultative bacillus about 2-4⇑ in length. It is actively motile and possesses numerous peritrichous flagellae from 8-20 in numbers. Salmonella is divided into three species:

S. cholerasuis, *S. typhi* and *S. enteritidis*. *Salmonella enteritidis* currently includes more than 2100 serotypes. Only a few serotypes are considered as zoonotic disease and so far isolated from man and animals in a specific region or country. *S. typhi* and paraTyphoid serotypes of *S. enteritidis*, paratyphi A and paratyphi C are Salmonellae specific for man. The serotype paratyphi B occupies an intermediate position which is less strictly adopted to man and found in cattle, dogs, swines and fowls (Pedro, 1980). *Sammonella* possesses three important types of antigens:

a. O-antigen (Somatic antigen):

Somatic antigen represents the side chains of repeating sugar unit projecting outward from the lipopolysaccharide layer on the surface of bacterial cell wall. More than 60 different antigens have been recognized and they are designated by Arabic numerals. The O-antigens are heat stable being unaffected by heating at 100^0C for 2.5 hours and alcohol stable (Mackie and Mc. Cartney, 1996).

b. H-antigen (Flagellar antigens):

Many Salmonellae are diphasic i.e. they can occur in two antigenic forms referred as phase-I and phase-II. Phase-I antiens are given alphabetical and phase-II antigens are given either numbered or a letter if known to occur in both phases.

c. Vi-antigen (Surface antigens):

Vi-antigen is helpful in phase typing of *S. typhi*, *S. paratyphi* C and rarely *S. dublin* as these serotypes possess this antigen (Bergery's Manual, 1990). "O" and "Vi" agglutinins produce fine granular agglutination while H-agglutinin brings about a large flocculent agglutination.

) Toxicity and Resistance:

Salmonella do not produce exotoxin. Their ability to produce disease in animal and human is associated with an endotoxin which is a gluco-lipo-protein complex and is characterized by its high toxicity (Pyatkin, 1967). Salmonellae are relatively stable to high temperature i.e. 60^0C to 75^0C, high salt concentration and to certain acids. They withstand 8-10% of acetic acid solutions for 18 hours and service for 75-80 days at room temperature (Pyatkin, 1967).

) Pathogenicity

Natural infection of Typhoid fever is by ingestion followed by penetration through the intestinal mucosa. Disease production depends on the several factors i.e. no. of organisms swallowed, state of gastric acidity and possession of Vi-antigen by the organisms. Pathogenesis of Typhoid fever may involve two toxins, an enterotoxin and a cytotoxin. Number of cells in the order of 10^7-10^9 per gram is generally necessary for onset of Typhoid fever. But some outbreaks are reported with relatively low number as well.

Salmonella organisms enter the body through oral route from where they enter intestinal lymphatic and then travel into the blood stream via the thoracic duct. They are then disseminated into many organs of the body. Pathogenesis of enteric fever can be described under the following heads.

a) Intestinal and mesenteric lesion:

The Typhoid bacilli first invade and multiple I the ileum as Payer's patch and in solitary lymphoid nodules of the large intestine. Multiplication stimulates the inflammatory response which confirms the infection of the gastro-intestine tract and mediates the release of prostaglandin.

Ingestion of S. typhi

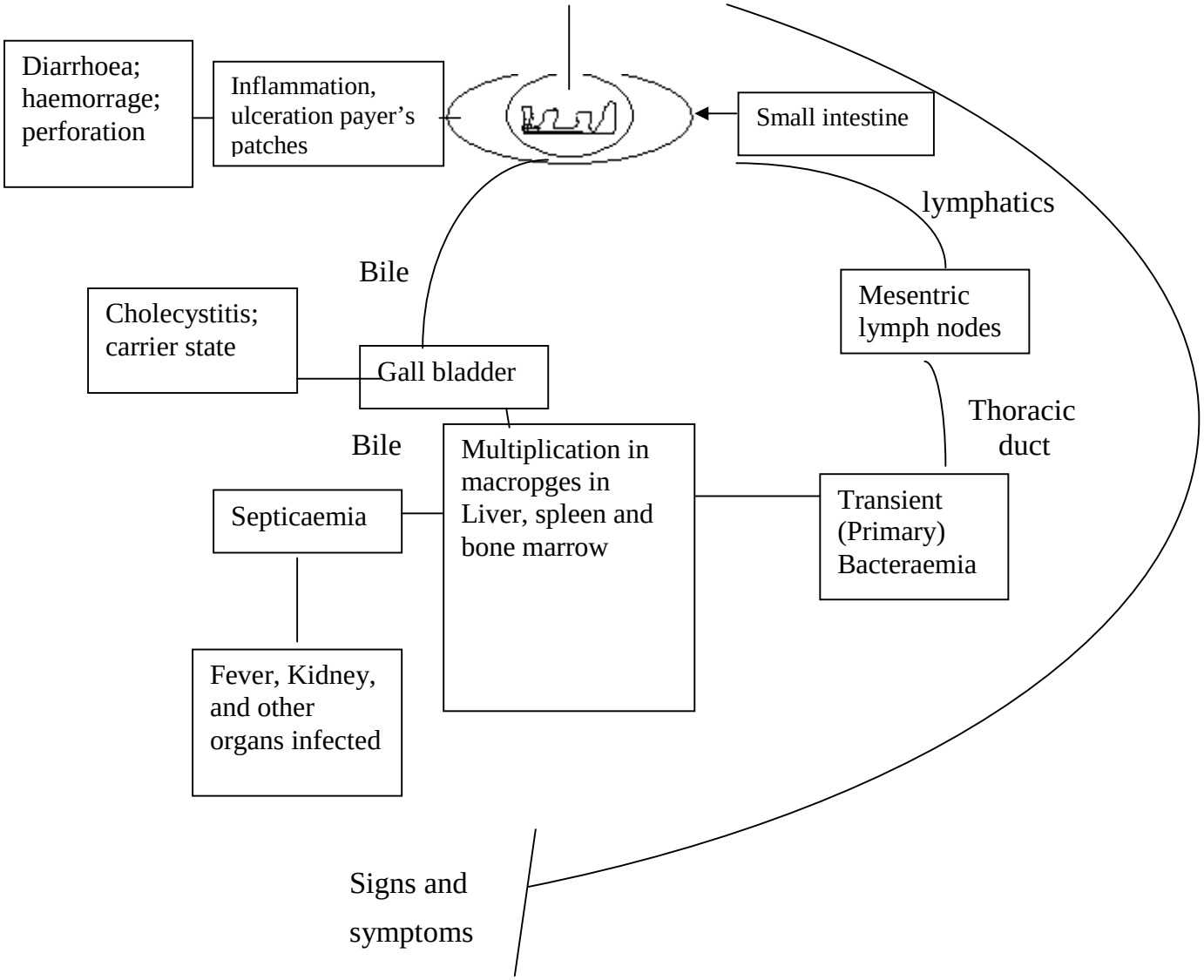

Fig.1: Pathogenesis of Typhoid fever (Schaechter, Medoff and Schlessinger, 1989)

b) Typhoid Bacteraemia:

Typhoid bacilli enter the blood stream from the intestinal lesion and lead to systematic illness. Symptoms like malaise, chills, headache, myalgia, abdominal discomfort and gradual elevation in temperature 39^0 to 40^0C. Spleen shows prominent changes, it is enlarged, soft, engorged with blood and microscopically it shows also many macrophages and clumps of Typhoid bacilli. Foci of accumulated macrophages, with or without focal areas of necrosis are found in the liver, bone-marrow and other tissues.

c) Toxemic effect:

In addition to focal lesions, the Typhoid patient suffers from toxic damage of myocardial, hepatic, renal and other parenchymatous cells due to the actual presence of blood born bacilli in various tissues.

- **Reservoir of Infection**

Man is the only known reservoir of infection, viz. cases and carriers.

a) Cases: The case may be mild, missed or severe. A case (or carrier) is infectious as long as bacilli appear in stool or urine.

b) Carriers: The carriers may be temporary (incubatory, convalescent) or chronic, convalescent carriers excrete the bacilli for 6 to 8 weeks, after which their numbers diminish rapidly. By the end of three months, not more than 4 percent of causes are still excreting the organisms, and by the end of one year, the average carrier rate is around 3 percent (Christie, 1974).

- **Source of Infection and Mode of Transmission**

The primary sources of infection are faeces and urine of cases or carriers, the secondary sources are contaminated water, food, fingers and flies. There is no evidence that Typhoid bacilli are excreted in sputum or milk.

Typhoid fever is transmitted via the faecal- oral route or urine oral rotes. This may take place directly through soiled hands contaminated with faeces or urine of cases or carriers or indirectly by the ingestion of contaminated water, milk and food or through flies.

- **Environmental and Social Factors**

Enteric fever is observed all through the year. The peak incidence is reported during July-September. This period coincides with the rainy season and an increase in fly population. Outside the human body, the bacilli are found in water, ice, food, milk and soil for varying periods of time. Typhoid bacilli do not multiply in water, many of them perish within 48 hours, but some may servive for about 7 days. They may survive for over a month in ice and ice-cream. They may survive for 70 days in the soil irrigated with sewage under moist winter conditions, and for half that period under drier summer conditions and they may multiply and survive for sometime in food. Typhoid bacilli grow rapidly in milk with altering its taste or appearance in any way. Vegetables grown in sewage farm or washed in contaminated water are positive health hazard. These factors are compounded by such social factors as pollution of drinking water supplies, open air defecation and urination, low standard of food and personal hygiene and health ignorance. Typhoid fever may therefore be regarded as an index of general sanitation in any country (Park,2005).

- **Incubation Period and Clinical features**

Usually 10-14 days, but may be as short as 3 days or 3 days or as long as 3 weeks depending upon the dose of the bacilli ingested.The incubation period of Typhoid fever varies with the size of the infecting dose, average (from 10-20 days) and range (from 3-56 days). In Paratyphoid fever it ranges from 1 to 10 days. The onset of the Typhoid fever is usually incidious but in children may be abrupt with chills and high fever.

The duration of illness in untreated cases of average severity is usually 4 weeks. In the first week the features are non-specific with headache, malaise, cough ad sore-throat, often with abdominal pain (constipation) and the fever in a stepladder fashion.

During the second week, the patient looks toxic and apathetic with sustained high temperature. The abdomen is slightly distended and splenomegaly is common and may be marked constipation, especially in early stage and marked abdominal distention. In about 50% cases, crops of 2-4mm diameter develop pink-papules (rose-spots) which fade on pressure developed on the upper abdomen and lower chest between seventh and twelfth days.

With the onset of third week, the patient becomes more toxic and ill. Continuous high fever persists and delirious confessional state stets which is called Typhoid stage. The patient is weak with a feeble pulse and rapid breathing; crackles may develop over the lung bases. Death may occur at this stage from overwhelming toxemia, myocarditis, intestinal haemorrhage or perforation and considerable weight-loss is common. In patients who survive into the fourth week, the fever, mental state and abdominal distention slowly improve over a few days but intestinal complication may still over (Park, 2005; Cook, 1996).

) Epidemiology

Typhoid fever is widely distributed in all areas of the world where standards of hygiene and sanitation are poor and is a main cause of death in those areas. Travelers to such places should be cautious about their drinking water supplies and type of food they consume (Durden, 1993).

Typhoid fever seems especially important in West Africa and it is also an increasing problem in travelers from industrialized countries to the tropics in the USA. 2666 cases of enteric fever were officially noticed between 1975 and 1984, 62% of them were imported from either Mexico or India (Cook, 1996).

It is widely distributed in the developing countries like Africa, Asia and Latin America. Typhoid fever is endemic in India. A limited study in an urban slum showed 1 per cent of children's up to 17 years of age suffers from Typhoid fever every year. Statistics for the period 1980 to 1986 showed on an average more than 3, 00,000 cases of enteric fever each year. Reported data for the year 1995 shows same picture with 329499 cases and 672 deaths (Govt. of India, HII, 1995/96).

III

OBJECTIVES

⁾ General objective

- To determine incidence of Typhoid fever by Widal test in suspected cases visiting Seti Zonal Hospital, Kailali and also to assess the KAP (Knowledge, attitude and Practice) of the people towards this disease.

⁾ Specific Objectives

- To determine genderwise incidence of Typhoid fever.
- To determine the age and genderwise incidence of Typhoid fever.
- To determine the monthwise incidence of Typhoid fever.
- To determine the month and genderwise incidence of Typhoid fever.
- To determine ethnic groupwise incidence of Typhoid fever.
- To determine the case fatality rate (CFR) of Typhoid fever.
- To find out the knowledge attitude and practice (KAP) among the community people about Typhoid fever.
- To recommend the preventive and control measure against Typhoid fever.

IV

LITERATURE REVIEW

) HISTORY OF TYPHOID FEVER

Typhoid fever is an ancient disease. Since the dawn of civilization dysentery has been one of the greatest scourges of mankind and has played an important role in the course of history. The Greek Historian Herodotus attributed the defeat of the invading Persian army in 480 BC due to endemic dysentery. Epidemics during wars are severe and associated with high mortality. It has been said that infectious diseases have dicided more battles than "Great Generals". In the Russo- Turkish war in 1928, there were 4563 deaths among 34,198 cases of dysentery and diarrhoea. There were 1478 deaths in 9000 cases in four months of the Crimean War, 2380 deaths in 38652 cases in the German army during the Franco – Prussian War in 1870 and 38094 deaths in 155140 cases during the Sino- Japanese War in 1894. Epidemic outbreaks of diarrheoa and dysentery have occurred over all the continents of the world throughout the history (Henry, 1976).

In 1860, Dr. William Budd discovered that contamination of water with human excreta was responsible for the transmission of Typhoid fever. In the United States, 450 to 500 cases of Typhoid are reported each year, but world wide there are approximately 12 to 15 million cases each year. Travelers to most underveloped countries are at a high risk for acquiring Typhoid (Robert, 1995).

During 1900s thousands of Typhoid fever cases and a few deaths were reported in U.S.A. Most of these cases arose due to drinking of contaminated water or eating foods handled by persons suffering from Typhoid fever and shedding *S. typhi*.

One of the most famous carriers of this disease was Mary Mallon. She worked as cook in 7 houses in New York City from 1896 to 1906. During the time of her work in these homes 28 cases of Typhoid fever occurred. The New York City Health department arrested Mary and admitted to the Hospital. She was found to be carried Typhoid fever causing bacteria without external symptoms of the disease. After being released she pledged not to act as cook. But she changed her name and began to work as cook again. For five years she spread Typhoid by shedding bacteria. In October 1914, she was engaged as work in the Sloane Hospital for women in New York, an outbreak of Typhoid occurred among the doctors, nurses and helper of the hospital between Jan to Feb of 1915 involving 25 cases. The cook was suspected and arrested, and held in custody for 23 years until she died in 1938. During her life time, she was linked with 10 outbreaks, over 1300 cases and 3 deaths (Robert, 1995).

) TYPHOID RESEARCH IN GLOBAL PERSPECTIVES

Yew *et al*., (1993) conducted the epidemiological study of Typhoid fever in Singapore. A total of 1452 cases of Typhoid fever were notified from 1980-1989. The morbidity rates of indigenous cases showed a steady decline from 5-9 per 100,000 populations in 1980 to 1.2 per 100,000 populations in 1989. The main CFR was 0.8%. Children, adolescents and young adults were most susceptible to Typhoid fever. There was no significant difference in morbidity rates between the major ethnic groups. Food was the main vehicle of transmission.

Gupta *et al*., (1994) reported the perforated Typhoid entries in children. A total of 65 patients (45 males and 20 females) ranging from 5-15 years with perforated Typhoid entries managed over a three year period at a University hospital having symptoms like fever, abdominal pain, vomiting and either diarrhoea or

constipation. Out of 65, 56 (86%) underwent two layer bowl closure after freshening of ulcer margins. The over all mortality ratio was 20%.

Lecour *et al*., (1994) reported a case of *S. typhi* meningitis in a 70 year old woman. The patient was treated with ampicillin and the only sequela was right sided deafness.

S. typhi is a food-born pathogen with continuing potential to cause large outbreak of Typhoid fever in United States. Birkhead, *et al*., (1993) recorded a large outbreak of 'Typhoid fever' with an unusual vehicle at a resort hotel in New York. The outbreak occurred in 1889 among guests and staff at a New York hotel. There were 43 culture confirmed and 24 probable cases among guests, one culture confirmed case and one asymptomatic culture positive case among hotel employees and one culture confirmed secondary case. Only the orange juice was the source of infection *S. typhi* was isolated from the stool of the patients.

Carmeli *et al*., (1993) conducted a comparative study on the occurrence of Typhoid fever in Ethiopian immigrants to Israel and native – borne Israelis. Typhoid fever remains a major cause of morbidity in developing countries with a CFR of 12% - 32%, whereas in developed countries this rate has successfully been reduced to less than 2%. The cause of this high CFR in developing countries was investigated by studying two populations of patients who had Typhoid fever during 1984-1985. After their study they concluded that the high CFR for Typhoid fever in Africa is due to delayed hospitalization and treatment rather than to differences in host factors or in the virulence of the pathogen and that mortality can be reduced by hastening hospitalization and treatment.

Maguire *et al*., (1993) reported a large outbreak of Typhoid fever in 206 person occurred in July and August. An analytical study of a cohort attending a function in the town showed a significant association between illness and consumption of cold pork supplied by a butcher's shop.

Fjaerli *et al*., (1993) described a family outbreak of Typhoid fever from Pakistan. In 1992, six members (mother and five children) of a family were admitted to hospital with Typhoid fever within a nine-day period. The index case was an 18 months old girl who had been hospitalized and treated elsewhere for Typhoid fever. The rapid spread of Typhoid fever in the family was due to insufficient hygiene precautions and inadequate antibiotic treatment of index case. Several co-existing factors as poor housing conditions and cultural barriers may also have influenced the outcome.

Benet *et al*., (1994) conducted a study of "Transient, asymptomatic colonization of new born, Ethiopian infants by *Salmonella*." They performed faecal cultures from 71 Addis Ababa infants. *Salmonella* species were found in 12 to 61 hospitalized infants. None had diarrhoea. Colonization was most common (8/21) during the second week. There was no correlation to mode of delivery, breast feeding and type of ward or antibiotic treatment.

Mirza *et al*., (1995) studied the prevalence and clinical features of mltidrug resistant *S. typhi* infections in Baluchistan, Pakistan. During the study period (Jan-July, 1994) a prospective study of bacteriaemia in 692 patients with fever without localizing signs was undertaken at the Qyetta Military Hospital. *S.* spp. were isolated from 76 (11%) of the patients, 62 had *S. typhi* and 14 had *S. paratyphi* A. Significantly more isolations of *S. typhi* were made in the hot dry months of May and

June than in the earlier months. Multidrug resistance to chloramphenicol, ampicillin and co-trimoxazole was found in 43 (69%) of the *S. typhi* isolates.

Khazenson *et al*., (1995) conducted an epidemiological study on salmonellas caused by *S. enteritidis* in some territories of the Russian Federation. They found that the rise in morbidity caused by *S. enteritidis* in the 2nd half of 1980's was due to the consumption of insufficiently heated infected chicken eggs and the inobservance of sanitary and hygienic rules in the preparation of food from chicken meat.

Lehmacher *et al*., (1995) found that consumption of contaminated paprika and paprika powdered potato chips were the vehicle of transmission of a nation wide outbreak of enteric fever in Germany between April and September 1993. They estimated the infective dose at 4-45 organisms with an attack rate of 1 in 10,000 exposed persons. A variety of serovars like *S. saintpaul, S. rubislaw* and *S. javiana* were isolated during the study period.

An epidemic of Typhoid fever in a 'Nursing Hostel' was investigated. Out of 60 students, 30 reported sick with the symptoms of Typhoid fever. Out of 30, 26 students were positive for the agglutinations of *S. typhi* but all the clinical specimens and samples of water, cooked food, swabs of utensils and swabs from hands of cooks, were negative for *S. typhi*, *S. paratyphi* A and *S. paratyphi* B (Sharma and Mishra, 1995).

Oboegbulam *et al*., (1995) conducted a micobiological study on cases diagnosed as Typhoid/enteric fever in SE-Nigeria. Total 809 patients suspected having Typhoid fever were investigated. *S. typhi* and *S. paratyphi* were cultured from the stool samples of 128 (16%) patients. Serological evidence of Typhoid fever was obtained in 83 (13%) of 620 of the patients examined by Widal test. A higher

proportion of paraTyphoid infection over Typhoid infection was recorded both by culture (56%) and by the Widal test (63%). The predominant serotype was *S. paratyphii* C.

Tasyaram *et al*., (1995) conducted a retrospective evaluation of enteric fever in terms of clinical and laboratory findings among 249 patients between 1984 -1994. Of the cases, 51.4% were diagnosed Typhoid fever, 12.1% paraTyphoid fever A and 36.5% paraTyphoid fever B. They recorded the disease was endemic every year and frequently seen in 13-30 age-group (72.3%) in the late summer and (47.1%) in autumn. The symptoms were high fever (98.0%), headache (64.7%), nausea and vomiting (382%) and diarrhoea (37.0%). The frequent clinical signs were splenomegaly 70.3%), hepatomegaly (50.2%), Typhoid fever tongue (49.8%), and relative bradycardia (48.0%); and rose spots (37.0%). Leucopenia was found in 32.5% while leucocytosis was found in 5.2%.

Obi *et al*., (1996) studied the infections with schistosomiasis, Typhoid fever and malaria among 268 (163 males and 105 female) patients in Endo state, Nigeria. The result showed that 95(58.3%) males and 67(63.8%) females were infected with *S. typhi*. Kulkarni *et al*., (1996) conducted an epidemiological investigation of an outbreak of enteric fever cases during Nov-Dec, 1995 which was explosive nature of outbreak, non-involvement of infants, and significantly higher incident rate in 1-14 age group. Chemical and microbiological examination of water samples gave the evidence of feacal contamination of water.

Fule *et al*., (1996) conducted a study on the outbreak of food poisoning due to *S. paratyphi*A in Maharashtra among 33 patients presented with acute diarrhoea and vomiting, 12-34 hrs after consuming vegetarian food. Twenty three patients developed high grade fever with two patients developing complications.

Menghous *et al*., (1997) conducted clinical and laboratory studies among 178 patients of Typhoid fever and found that most of cases had sustained fever (66.3%) and gastrointestinal symptoms as the disease progressed, raised spots in 32.6%, enlarged liver and spleen in 69.5%, blood eosinophil disappeared in most and leucopenia was found in 94.3% patients.

Ali *et al*., (1997) conducted a cross-sectional study over a 6 years period among 791 patients with multidrug resistance Typhoid fever, of whom 665 (84%) individuals developed neuropsychiatric manifestations. These were acute confusional state (73%), myelitis (6%), cerebrallitis (1%), Parkinsonism (1%), acute psychosis (0.6%) and meningoencephalities.

Velema *et al*., (1997) performed a hospital based case control study to identify high risk groups and routes of transmission of Typhoid fever in the Ujung Pandang city of Indonesia. The IR of this disease was 3.1/1000 and CFR 5.1%. The risk groups consisted of those who were single, unemployed and those who had university education. Median age of cases was 22 years. Consumption of food from food stalls in the street and their hand washing practice were strongly associated with the risk.

Richens, (1998) conducted a hospital-based perspective of the epidemic of Typhoid in the Goraka area from 1998. The monthly admission for Typhoid fever to hospital showed a peak in 1998. The sex and age distribution showed a predominance of young adults. The CFR was 10-15% in 374 patients, 27% were assessed as having severe Typhoid and this group had a CFR of 44%. The high mortality occurred due to septic shock; ileac perforation was found in 1.3% and rose-spot was found in 30% of patients. Blood and bone-marrow culture were used to confirm the diagnosis.

In Indonesia as well as in many developing countries, Typhoid fever is still endemic and prevalent. In Indonesia about 640,000 – 150,000 cases of Typhoid fever were recorded with mortality of 1.6 - 3% (Sudjana and Jusuf, 1998).

Enteric fever is a systematic illness caused by Salmonellae infection with *S. typhi, S. paratyphi* and *S. enteritidis* being the most common serotypes. Humans are the only reservoir for *S. typhi* (Kraus *et al*., 1999)

Khan *et al*., (1999) found that the clinical features, laboratory findings and complications of Typhoid fever were correlated with sex through a retrospective case note view of 102 hospitalized culture +ve patients in Durban, South Africa. Intestinal perforation (P= 0.04), occult blood losses in stools (P=0.04) and a mild reticulocytosis (P=0.02) occurred more frequently in males than in females. A single pre-treatment widal O-antibody titer less than equal to 1:640 was also a statistically significant occurrence in males. Female patients were significantly more severely ill (P = 0.0004) on admission and had chest signs consistent with bronchopneumonia (P =0.04), transverse myelitis (P=0.02). Typhoid hepatitis (P=0.04) and glomerulonephritis (P = 0.02) were present significantly more frequently in females.

Typhoid fever remains a significant public health problem in Southern Asia, particularly with the emergence of multidrug-resistant strains of *S. typhi* in the late 1980s. Children under 6 yrs. of age diagnosed as Typhoid fever on the basis of positive Widal test in a pediatric teaching hospital (Doherty *et al*., 2000).

Valenciano *et al*., (2000) conducted a study to investigate concurrent of outbreaks of gastroenteritis and Typhoid fever that occurred among guests of a party on a Floating restaurant in France in March 1998. A total of 133 guests reported gastroenteritis within 12 days supper and 27 guests developed Typhoid fever. The

result suggested that the food items served during the supper, chicken and rice were the vehicle of both gastroenteritis and Typhoid fever.

S. enteritidis still remains as the most common serotype isolated from human sources and foods. Foods frequently implicated in food-borne outbreaks are chicken meat and eggs, as well as their products particularly raw and undercooked ones (De Almeida *et al*., 2000)

According to official reports of sanitary epidemiological institutions the morbidity for Typhoid fever has been decreased for the last 15 years. The prevalence of disease was different inregions of Uzbekistan. Typhoid fever spread through any contamination way, the main one being through water reservoirs. Several outbreaks were noted in the Samarkand province. Adult men were affected frequently (Mirtazaev *et al*., 2000).

Saha *et al*., (2001) studied the age distribution of Typhoid fever including the degree of *S. typhi* among 538 Typhoid patients at a highly endemic area in Bangladesh. *S. typhi* was the single most common pathogen in monsoon and summer seasons and lowest in wineter. The majority (54.5%) of *S. typhi* isolates were from children of age below 5 years. In 1998 and 1999, there were three outbreaks caused by *S. enteritidis* in Shiga Prefecture in Japan. One outbreak was suspected to be a diffuse outbreak; caused by consumption of frozen cream puffs (Matsune *et al*., 2001).

Transmission of pathogens with drinking water is a widespread problem, which affects not only the countries with low hygienic standards but the industrialized countries as well. The pathogens are excreted by man or animals and are picked up

orally. Chlorination of drinking water should be done in order to stop the spreading of pathogens especially Typhoid fever by drinking water (Schoenen, 2002).

Salmonella spp. was the major cause of reported food-borne disease in the state of Rio Grande, South Brazil. According the data supplied by the Division of Sanitary Surveillance during the period of 1997to 1999, a total 8217 people were involved and 1557 had to be hospitalized. The highest no. of outbreaks occurred during spring time and the principle age group affected was between 16 and 50 years. The most common food vehicle as salad prepared with homemade mayonnaise (42.45%).

Salmonella is a common cause of bacterial food- born illness in USA. The epidemiological and costs of non-Typhoidal salmonellosis in California from 1990 through 1999 are described using surveillance, hospitalization and death data. There were 56,660 reported cases, 11102 hospitalizations and 74 deaths attributed to *Salmonella*. Among reported cases, infants had the highest rate (121 cases per 1000000 persons/year). The highest hospitalization rates were among the elderly and young children. Most deaths occurred among persons aged 65 or more (59%). The estimated 10 year hospitalization costs for S*almonella* were $200 million. Salmonellosis is a costly disease that disprotimately affects young and elderly (Trevejo *et al*., 2003).

The principle causes of Salmonellosis were raw materials not submitted to regularly inspection (22.92%), mainly eggs and foods maintained at room temp. more than 2 hrs (20.55%). The majority of the outbreaks occurred in private homes (43.70%) and commercial food establishments (25.21%) (Costalunga *et al*, 2002)

Reller *et al*., (2003) conducted an epidemiological investigation to find out the sexual transmission of Typhoid fever, they reported a case having sex with an asymptomatic male *S. typhi* carrier and they documented sexual transmission of Typhoid fever, which may be acquired by means of oral and anal sex, as well as via food and drink.

Typhoid fever is difficult to differentiate from other causes of infection as malaria because their signs and symptoms often overlap. There has been an unprecedented increase in the no. of Typhoid fever in Cameroon. Febrile patients are often treated for malaria and Typhoid fever simultaneously. This cross-sectional study was carried out by Nsutebu, *et al.*, (2003) to determine the prevalence of Typhoid fever in 200 consecutive patients with fever and symptoms clinically compatible with Typhoid fever to verify recent estimates of high prevalence of Typhoid fever. Patients were enrolled in three of the 10 provinces of Cameroon. Blood culture, thick and thin blood smears and Widal test using acute sera was performed in all cases. Typhoid fever was confirmed only in 2.5% as evidence either by culture (four cases) of high salmonella-antibody titers (one case); malaria was diagnosed in 94(47%) patients. Typhoid fever is not as endemic in Cameroon as recently feared.

) TYPHOID RESEARCH IN NEPAL'S PERSPECTIVES

Study regarding status of Typhoid disease is also of great concern for Nepal. Malla and Shakya (1984) reported that Typhoid fever is endemic to Kathmandu. The attack rate of Typhoid fever in Kathmandu is 126.2/1000 (Sharma, 1995).

According to annual report of Central Food Research Laboratory (C.F.R.L.) 1996/97 microbiological analysis of various food commodities were

carried out and *Salmonella* was detected in three samples of sausage out of 23 samples, in 1 samples of dry meat out of 20 samples, in 1 sample of Kachila out of 14 samples and in 1 sample of Chhwela out of 10 samples. In annual bulletin of CFRL 1997/98 *Salmonella* was reported from the raw frozen pork sample in Prasuma Factory during the processing of momo, (momo is an item of minced meat). *Salmonella* was also detected in raw pieces, on surface meat and in mixing dough. In the same report *Salmonella* was also reported from 3 samples of raw momo out of 29 samples. Similarly in the fiscal year 2000/2001 CFRL reported *Salmonella* from 10 samples of raw momo out of 20 samples tested and in 4 simples of steamed momo out of 27 tested samples. *Salmonella* was also found to be present in hotel foods like bectifish, fish and chevon leg.

According to annual report of Central Food Laboratory (C.F.L.) 2004/2005 altogether 267 samples of different food and food products were analysed for their hygienic quality, Coliform contamination was found in 70 samples. Similarly 157 samples of milk and milk products were analysed. Out of which, 29 samples were found to be contaminated with coliform. Similarly, a total of 140 samples of processed drinking water and drinking water were analysed. Out of which, 29 samples were substandard due to high total mesophilic bacterial count ,coliform count, faecal coliform and *E. coli.*

An epidemiological study of Salmonellosis was carried out during April 2003 to October 2003 in Kanchanpur district i.e. Mahakali Zonal Hospital and Mahendranagar municipality to find out the epidemiological status of Typhoid fever. A total of 176 blood samples from the suspected persons having the symptoms of Typhoid fever were examined by Widal test. Among these, 51 samples (29 males and 22 females) were found positive for Typhoid fever .The incidence rate was found to

be 0.13 per 1000 per year. Case fatality rate was found to be zero.The high incidence of the Typhoid fever was found in the age group 10-29 years while least in the age group 40-60 years.The highest incidence of Typhoid fever was found in summer and autumn season (Kapadi, 2005).

An epidemiological review of acute diarrhoea cases in Nepal during outbreak season in 1994 was carried out. Maximum numbers of cases were seen in central region. In Kathmandu case fatality rate (CFR) was found to be 36%. This study showed high prevalence of diarrhoea cases in Kathmandu attributed to the fact that dense population, lack of potable water supply and contaminated water and vegetable are responsible for the disease. Total 62733 cases were reported from all over Nepal out of which 448 cases died (Shrestha, 1995).

A survey was carried out between June and November 1990 to find out the prevalence of *Salmonella* (the causative agent of enteric fever) in dairy products sold in street of Kathmandu valley. A total of 200 samples of various daily products were collected. *Salmonella* was isolated from 3% samples. Variety was 12.5% in ice cream and 2.1% in sweet item.

A study about the bacteriological quality of ground water in urban Patan was carried out. A total of 70 water samples randomly collected from different water sources. Out of tatal collected samples, 85.6% samples showed presence coliform and 60.6% contained faecal coliforms. In the study 120 enteric bacteria were isolated in 49 samples. *Salmnella* was present in 10.8% cases; other common isolates were *E. coli* and *Citrobacter.* Antibiotic sensitive pattern showed 28.6% *Salmonalla* spp. resistant to multiple antibiotics (Maharjan and Shrma, 2000).

A diagnostic study was carried out during Feb.14, 1985 to Oct.15, 1992 in microbiology laboratory of Tribhuvan University teaching hospital, Kathmandu, Nepal.Total 214 bile fluid specimens were analyzed to find out the incidence of Salmonella colonization in bile. *Salmonella typhi* was isolated in 3.2% cases out of 42% cases of bacterial colonization (Joshi *et al*, 1997).

In annual report of Epidemiology and Disease Control Division of the year 2000 on Typhoid (enteric fever) cases admitted to Sukraraj Tropical and Infectious Disease hospital, Teku was published. A total of 190 cases were admitted out of which 1 case died i.e. CFR rate = 0.5%. The maximum numbers of Typhoid cases were admitted in month of Bhadra i.e. 46 cases and minimum number of cases were admitted in month of Chaitra.

According to the outbreak reports sent to EDCD, (2002) outbreak of Typhoid fever occurred only in Dhanusha district in Dhangadawa VDC in the month of Shrawan. One hundred cases were diagnosed as typhoid by Widal test and nobody died from this disease. Population at risk and age wise distribution of the cases was not mentioned.

) Significance and Evaluation of Widal test

▪ Evaluation of the Widal test for the diagnosis of Typhoid fever

Typhoid fever is a major public health problem in developing countries. In London, where the sanitary infrastructure was severally damaged during the civil war, the high prevalence of Typhoid fever creates a pressing need for a rapid and reliable diagnostic tool. To evaluate the diagnostic usefulness of the widal test, patients with positive blood culture for *S. typhi* (n = 78) were compared to controls with fever due to another infection (n = 96). Discrimination between the patient group and the two control groups was the best when an agglutinin O titer of 1/160 or more was used. With this cut off, sensitivity was 67.9%; specificity was 93.8% versus the febrile controls and suggests widal test remains a valuable tool for the diagnosis of Typhoid fever (Hamze *et al*., 1998)

▪ Value of a single widal test in the diagnosis of Typhoid fever

Rasaily *et al.,* (1993) conducted a study to determine the value of a single widal test in the diagnosis of Typhoid fever among 116 bacteriologically confirmed Typhoid fever patients, 170 clinically suggestive but culture negative and 98 non-typhoidal febrile illness and 54 normal control children and reported that high specificity and positive predictive value in 1:160 dilution makes the widal test acceptable as a diagnostic tool.

▪ Interpretation of the widal test in the diagnosis of Typhoid fever

The value of widal test in diagnosing Typhoid fever was accessed in children aged between 1 and 10 years in Bangladesh. Saha *et al*., (1996) conducted a study with case control on sera specimens and suggested that in children in an endemic area a positive widal test is of considerable importance in diagnosis of Typhoid fever.

V

METHOD AND MATERIALS

❖ Study Area

Kailali district is situated in the terai belt of Seti Zone, Far-Western Development Region of the kingdom. It lies 28°22´N to 29°05´N longitude and 80°30´E to 81°18´E longitude. The area occupied by the district is 3235 sqkm which covers 2.20% of the national figure. It is located at the altitude of 179m from the sea level. The recorded maximum temperature is 43.8^0C in summer and 10^0C in winter. The district is divided into two municipalities and 42 VDCs. Dhangadi is the head quarter of the district. The journey takes about 17 hours by bus from Kathmandu.

The total population is 6, 16,697 (out of which 3, 12,311 are males and 304,386 are females) which stands 2.66% of the total population of kingdom. The total number of households are 94,430. The literacy is 52.6% (64% male and 41% female literacy). Annual growth rate is 3.89%; population per doctor is 38,032 and population per hospital bed 2,765.

There is a zonal hospital (Seti Zonal Hospital) of 52 bed capacity in the head quarter of the district with the shortage of professional man power. The district has one regional health center, one Zonal Ayurvedic Aushadhalaya, one eye hospital, 5 primary health care centers, 8 health posts, 30 sub-health posts, 225 EPI clinics, 6 DOTS centers and 2 blood transfusion service centers.

Mostly Kailali district is inhibited by different castes: tharus(43.7%), brahmins(10.73%), chhetris(17.42%), magar(3.88%), kami(6.21%) and others are tamang, newar, sunars, lohars, muslim, tamata, musahar, majhi etc which differ in their culture, tradition and socioeconomic status.

Agriculture is the main occupation of this region. Most people inhibiting in this region are illiterate, unemployed, and traditionally conservative, unaware about disease and their cause. Poor knowledge about prevention and control measures of diseases are also the main issues and aspects of this region.

The government hospital in the centre is only the curing centre. Besides, most of them depend on private pharmacies of the city, and nearby town-areas like Palia, Lakhimpur, Poligung, Pilibhit, Bareilly and Lucknow of India for their treatment.

The present study was carried out in the Seti Zonal Hospital from the patients having the symptoms of the Typhoid fever and other information from the households to know the knowledge, attitude and practice was collected from the ward no. 7 of Dhangadi Municipality, Kailali and from the guardians of the suspected patients of Typhoid fever.

- **Method**

The present study was conducted from June 2005 to May 2006, in order to determine the incidence of Typhoid fever in Kailali District; the study was designed in two different phases; I) Laboratory diagnosis and II) Questionnaire survey

I. Laboratory Diagnosis:

- **Selection of patients for blood sample collection**

Among the patients visiting Seti Zonal Hospital, a total of 936 blood samples were collected from the patients having fever along with at least two or all of the following symptoms.

i) Fever, ii) Headache, iii) Abdominal disorder/discomfort

iv) Nausea/Vomiting and v) Malaise

⁾ Blood sample collection

Blood sample for confirmatory test of Typhoid fever was collected from the fore-arm of suspected patients by veinpuncture using disposable syringe after cleaning the spot with provodone-iodine in 70% alcohol, with scrupulous care to avoid contamination then the blood sample was collected in sterilized test tube and serum was separated by centrifugation.

⁾ Widal test

The stained Salmonella antigens were used to detect identity and quantitative specific antibody in the serum sample from the suspected patients of Typhoid fever. These antigens facilitate the reading of agglutination in slide test in the serum of patients suffering from enteric fever (Sood, 1994).

Procedure:

- Sterilized plastic micro titer plates were taken and the serum sample was placed in the wells of plates with the help of micropipette.
- Then equal volume of the antigens 'O', 'H', 'AH', 'BH' and quality control were added in the respective wells of the plastic plate.
- The contents of the each spot were mixed with the help of sterilized plastic sticks and then shaken vigorously for three minutes and observed for agglutination.
- The presence of Salmonella serotypes was confirmed by observing agglutination along with the control.

- **Quality control**

Quality control was applied in sample collection, preservation and handling of the equipments along with the sterility of the test medium.

Control test was also performed to conform the correct working of stained Salmonella antigens. All the positive cases (plates showing positive Widal test i.e. agglutination) were verified by the laboratory technician of Seti Zonal Hospital, Dhangadi, Kailali.

II. Questionnaire Survey

According to Population Census 2001, it has been shown that there are 815 households in ward no. 7 of Dhangadi Municipality of Kailali district, inhibited by a population of 5531, out of which 2885 are males and 2646 females (CBS,2001). The area was selected after the pilot survey having the histories of Typhoid fever cases. Out of total 815 households, 196 houses were selected randomly for the questionnaire survey by using random numbers.

A structured questionnaire was prepared basically focusing KAP including symptoms, mode of transmission, preventive and control methods of 'Typhoid Fever.' Questionnaire was presented and was allowed for pilot survey before administration.The final set of questionnaire was administered primarily with the household head of each of selected household (The questions are listed in Annex-1(B)). Similarly, all the positive widal test people were interviwed through a set of structured questions to know their knowledge, attitude and practice (KAP) regarding typhoid (The final set of questions are listed in Annex 1(A)).

⁾ Sources of Data Collection

This study was based on both primary and secondary data. Both types of data were collected from following sources.

- **Primary Sources:**

Primary data was the main source of data to fulfill the objectives of the study. Four major procedures mainly survey by structural questionnaires, collected samples, analysis of collected samples and selected field observations were conducted for study.

- **Secondary Sources:**

The secondary data were collected mainly from Seti Zonal Hospital, Health posts, sub-health posts and other health institutions of that area. Similarly various books, journals, magazines were also used for the detail information on related field.

⁾ Statistical Tools

| For measuring the incidence rate (I.R.), the formula was

$$\text{I.R.} = \frac{\text{No. of new cases of specific disease during given period}}{\text{Population at risk}} \times 1000$$

| The case fatality rate (CFR) was measured by using following formula;

$$\text{CF.R.} = \frac{\text{Total no. of deaths due to particular disease}}{\text{Total no. of cases due to the same diseases}} \times 100$$

The collected data were analyzed and interpreted statistically by using following statistical tools and techniques.

| For measuring knowledge, attitude and practice (KAP) of the people about Typhoid fever, the statistical method was the Chi-Square Test. $\chi^2 = \frac{(O - E)^2}{E}$

With (n – 1) d.f. at 95% confidence limit. Where, O = observed frequency,

E = expected frequency.

❖ **Materials**

- **Materials and equipments used for blood sample collection and preservation**

i. Test tubes
ii. Disposable Syringe
iii. Cotton swab
iv. Methylated spirit
v. Tourniquet
vi. Test tube stand
vii. Marker
viii. Vials
ix. Laboratory manual (Record book)
x. Centrifuge

- **Materials and equipments used for "Widal Test"**

i. Stained – Salmonella antigens
ii. Micro pipette
iii. Widal test Kit/plastic micro titer plates
iv. Sterilized stick
v. Rotator//Shaking instrument
vi. Record book etc.

VI

RESULTS

The results of the study has been presented in two forms; i.e. laboratory findings analyses and questionnaire survey analyses.

I. The laboratory findings analyses

❖ General incidence of Typhoid fever in suspected cases

During the study period June 2005 to May 2006, nine hundred and thirty six (936) suspected cases for Typhoid fever were recorded in Seti Zonal Hospital, Dhangadi, Kailali and blood samples from suspected cases were collected for Widal test. Among the total (936) examined samples, 289 (30.87%) were recorded having positive Widal test(Table no.1).

Table No. 1: General incidence of Typhoid fever in suspected cases

Year Jun.2005 to May2006	Total no of suspected cases	No.of positive Typhoid patients	Positive Percentage (%)
June	81	32	39.51
July	113	46	40.71
Aug	**128**	54	**42.19**
Sep.	97	28	28.86
Oct.	76	18	23.68
Nov.	51	07	13.72
Dec.	42	04	09.50
Jan.	32	03	09.37
Feb.	57	10	17.54
March	83	18	21.68
Apr.	81	29	35.80
May	95	40	42.10
Total	936	289	30.87

) Monthwise incidence of Typhoid fever in suspscted cases

During the study period ,out of total 936 suspected cases maximum suspected cases were recorded in the month of August i.e.128, among which 54 (42.19%) were found positive for widal test whereas minimum suspected cases were recorded in the month of January i.e.32, among which 3 (9.5%) cases were positive for widal test (Table no.1, Fig. 2).

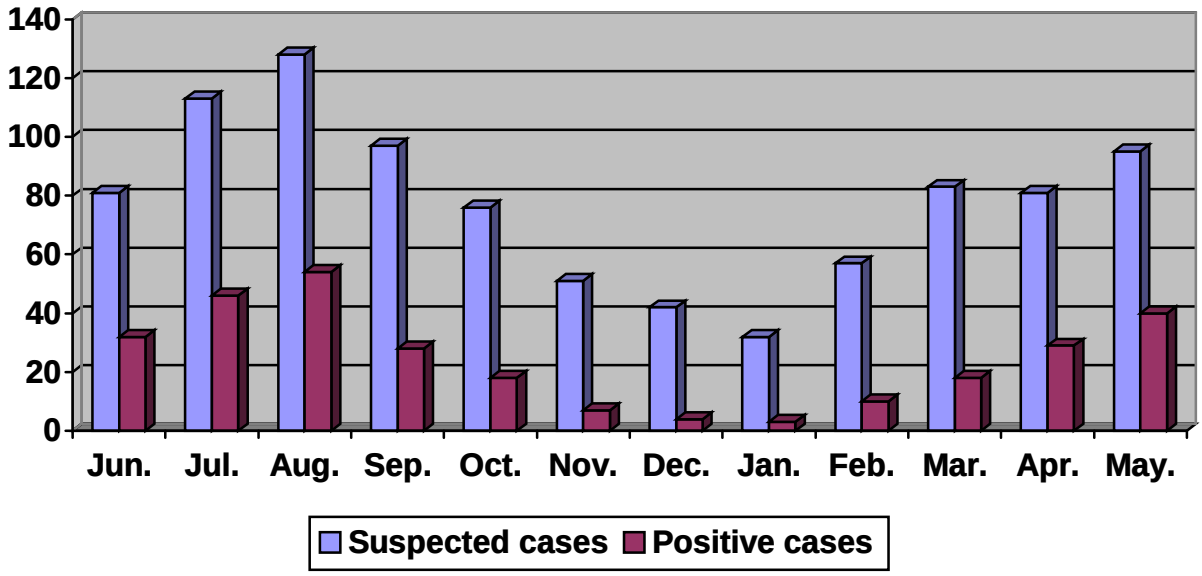

Fig.2: Graph showing month- wise incidence of Typhoid fever in suspected cases

❖ Gender and month-wise incidence of Typhoid fever in suspected cases

During the study period June 2005 to May 2006, among total (936) suspected cases (936 collected blood samples), maximum suspected cases were recorded in the month of August having 75 males and 53 females, out of which 33 males and 21 females were positive for widal test, where as minimum suspected cases were recorded in the month of January having 32 males and 9 females, out of which 3 males were positive and no any female was positive for widal test. The incidence of Typhoid fever in suspected cases was recorded 31.02% in males and 30.69% in females i.e. 310.2 per 1000 per year in male and 306.9 per 1000 per year in female (Table no. 2).

Statistically, the result revealed that there was insignificant difference between the gender and infection of Typhoid bacilli ($\chi^2 = 0.01$, $P<0.05$, d.f.1) whereas there was significant difference between the attack of Typhoid bacilli and different months of the year ($\chi^2 = 55.05$, $P<0.05$, d.f. 11).

Table No. 2: Gender and month-wise incidence of Typhoid fever in suspected cases

Duration	Male			Female		
June.2005 to May.2006	Total no. of blood samples examined	No. of blood samples showing positive widal test	Positive (%)	Total No. of blood sample examined	No. of blood samples showing positive widal test	Positive (%)
Jun.	49	20	40.82	32	12	37.5
Jul.	64	27	42.19	49	19	38.77
Aug.	75	33	**44.00**	53	21	**39.62**
Sep.	44	14	31.82	53	14	26.41
Oct.	45	11	24.44	31	07	22.58
Nov.	29	03	10.34	22	04	18.18
Dec.	27	02	7.41	15	02	13.33
Jan.	23	03	13.04	9	00	0.00
Feb.	32	05	15.63	25	05	20.00
Mar.	40	07	17.50	43	11	25.58
Apr.	30	10	33.33	51	19	37.25
May	61	26	42.62	34	14	41.17
Total	519	161	31.02	417	128	30.69

❖ **Gender and age-wise incidence of Typhoid fever in suspected cases**

The age groups of suspected patients were categorized into the difference of 10 years up to 70 and above. The result indicates that both male and female of these age groups were susceptible to Typhoid infection.The results also clear that the male and female of age group 10-19 years in both sexes have the highest incidence of Typhoid fever. No case of Typhoid fever was recorded from 60 above age group of female and 70 years above age group of male. The incidence of Typhoid fever was found to decrease with the increase in age of the people (Table no.3, Fig. 3).

The result revealed that there was significant difference between the different age groups and infection of typhoid bacilli (χ^2 =12.52, P<0.05, d.f. 3).

Table No.3: Gender and age-wise incidence of Typhoid fever in suspected cases

Male				Female		
Age group (in yrs.)	Total no. of blood samples examined	No. of blood sample showing positive widal test	Positive (%)	Total no. of blood sample examined	No. of blood sample showing positive widal test	Positive (%)
Below 9	55	16	29.09	64	18	28.12
10 – 19	155	56	**36.13**	131	45	**34.35**
20 - 29	148	51	34.46	125	42	33.6
30 – 39	59	17	28.81	40	12	30.00
40 – 49	56	13	23.21	26	07	26.92
50 – 59	27	05	18.52	18	04	22.22
60 – 69	19	03	15.79	13	00	00
70 and above	00	00	00	00	00	00
Total	519	161	31.02	417	128	30.69

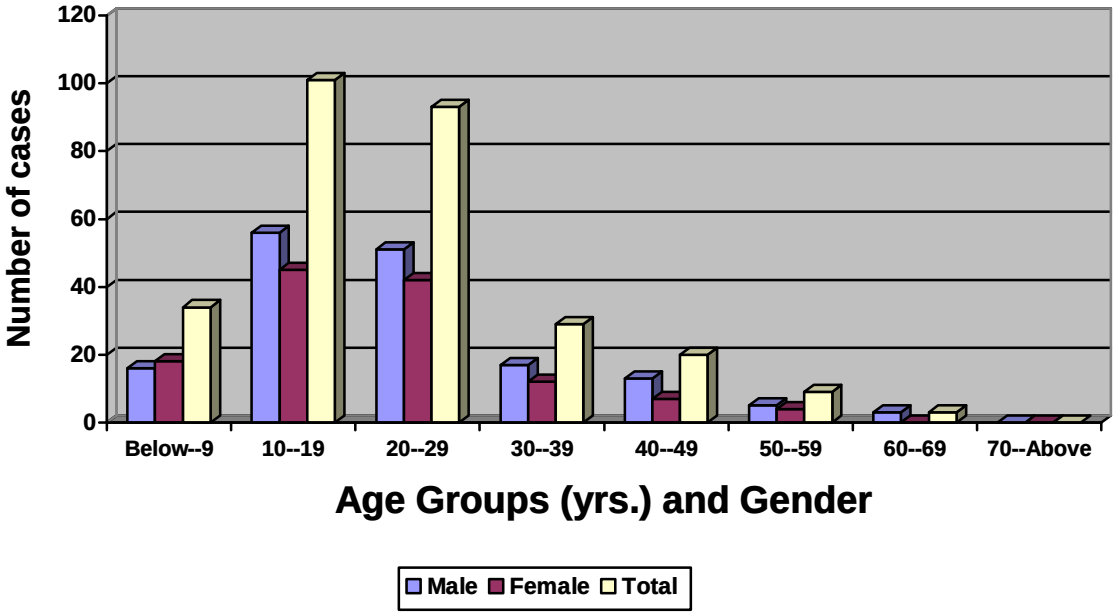

Fig.3: Graph showing gender and age-wise incidence of Typhoid fever in suspected cases

❖ **Incidence of Typhoid and Paratyphoid serotypes in suspected cases**

During the study period, out of total 936 suspected cases, 289 cases were found positive for Typhoid and Paratyphoid serotypes. Among the total 289 positive cases, maximum 216 (74.74%) were found having O-serotypes, 177 (61.24%) were suffered from H-serotype, 87(30.10%) were suffered from BH-serotypes and AH-serotypes was found in 36 (12.45%) patients. The result shows that the O-serotype was dominant, which was the important cause of Typhoid fever, where as AH- serotype was found the least (Fig. 4).

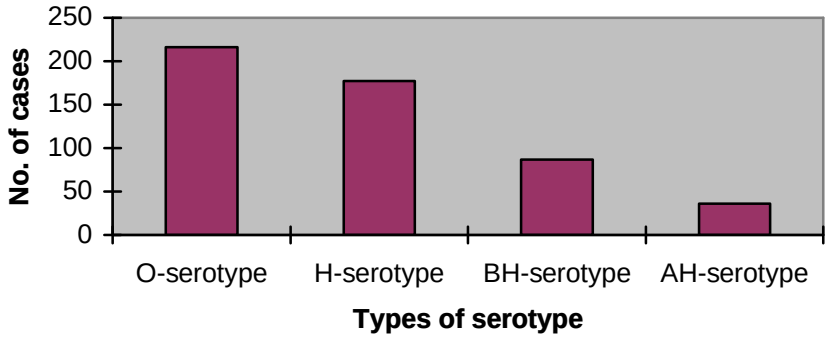

Fig.4: Graph showing Typhoid and Paratyphoid serotypes

❖ **Ethnic-groupwise incidence of Typhoid fever in suspected cases**

During the study period, among the total 289 cases of Typhoid patients, maximum i.e. 89 (39.79%) were found in Dalits and the minimum i.e. (21.11%) were in Brahamins, whereas the number of cases in Chhetris was 77 (26.64%) and the number in Baishyas was 62 (2145%) (Table no.4, Fig. 3)

Table No.4: Ethnic-groupwise incidence of Typhoid fever in suspected cases

.N.	Ethnic-groups	No.of Typhoid patients	Positive (%)
	Brahamins	61	21.11
	Chhetris	77	26.64
	Baishya	62	21.45
	Dalits	89	30.79
otal		289	99.99

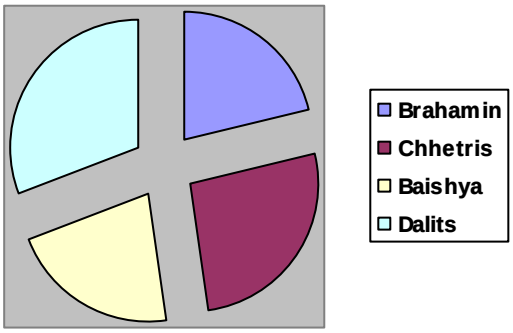

Fig.5: Pie-chart showing ethnic-groupwise incidence of Typhoid fever in suspected cases

❖ **Incidence rate (IR) of Typhoid fever in Kailali district**

"The number of new cases occurring in a defined population during a specific time period" is known as incidence rate (IR). Incidence rate (IR) is given by the formula;

$$IR = \frac{\text{No. of new cases of specific disease during a given time period}}{\text{Population at risk during that time period}} \times 1000$$

The total population of Kailali district is 616697 and the total no. of typhoid cases were found 289. Hence, the incidence rate of Typhoid fever in Kailali district was 0.46/1000 /year (Table no.5).

Table No. 5: Age groups and genderwise incidence rate of Typhoid fever in Kailali district

Age groups (in years)	Male			Female			Total		
	Population at risk	Typhoid Cases	IR	Population at risk	Typhoid Cases	IR	Population at risk (male and female)	Typhoid cases	IR
Below 9	89541	16	0.17	85478	18	0.21	175019	34	0.19
10 – 19	78031	56	0.71	76469	45	0.58	154500	101	0.65
20 – 29	51448	51	**0.99**	54257	42	**0.77**	105705	93	**0.87**
30 – 39	36777	17	0.46	35397	12	0.33	72174	29	0.40
40 – 49	24425	13	0.53	23447	07	0.29	47872	20	0.41
50 – 59	16859	05	0.29	14812	04	0.27	31671	09	0.28
60 – 69	9916	03	0.30	9412	00	0.00	19328	03	0.15
70 and above	5314	00	0.00	5114	00	0.00	10428	00	0.00
Total	312311	161	0.51	304386	128	0.42	616697	289	0.46

⁾ Sex-wise Incidence rate of Typhoid fever in Kailali district

The sex-wise incidence rate of Typhoid fever in Kailali district in 2005-2006 was found 0.51/ 1000/year in male and 0.42 /1000/year in female (Table no.5).

⁾ Age and genderwise incidence rate of of Typhoid fever in Kailali district

The highest incidence rate of Typhoid fever was found among the age group 20-29 years of both sexes i.e. 0.99 in males and 0.77 in females whereas the least incidence rate was found among the age group below 9 years of both sexes i.e. 0.17/1000/year in males and 0.21/1000/year in females. No case of Typhoid fever was recorded from 60 above age group of female and 70 years above age group of male. The incidence of Typhoid fever was found to decrease with the increase in age of the people (Table no.5).

❖ Case fatality rate (CFR) of Typhoid fever in Kailali district

The case fatality rate (CFR) was measured by using the formala;

$$CFR = \frac{\text{Total no.of death due to Typhoid fever}}{\text{Total no.of cases due to the Typhoid fever}} \times 100$$

The case fatality rate (CFR) of Typhoid fever in Kailali district was found zero during the study period since there was no any recorded case of the death due to Typhoid fever.

II. Questionnaire Survey Analysis:

The questionnaire survey analysis has been presented in two forms i.e. interview with positive widal test people and interview with household heads of the randomly selected houses of ward no. 7 of Dhangadi Municipality.

❖ Interview with positive widal test people:

All the positive widal test people were interviewed through a set of structured questions (Questions are listed in Annex-1A) and the following result was obtained.

⁾ Symptoms of Typhoid fever

Fever, intense headache, abdomen pain, diarrhoea and loose stool are the major symptoms of Typhoid fever. 289 patients with positive Widal test for Typhoid fever were interviewed and studied for clinical profile. The common clinical features were fever (100%), intense headache (84.43%), abdomen pain (34.95%), diarrhoea and loose stool (40.83%), vomiting and nausea (29.76%) and cough in (28.37%) (Table no. 6).

Table No. 6: Symptoms of Typhoid fever

S.N.	Symptoms	No. of patients			
		Male	Female	Total	Percentage (%)
1	Fever	161	128	289	100
2	Intence headache	135	109	244	84.43
3	Abdomen pain	57	44	101	34.95
4	Diarrhoea those stool	65	53	118	40.83
5	Vomiting	40	46	86	29.76
6	Cough	42	40	82	28.37

) Behaviour/ practice of Typhoid patients

A study was conducted to find out the practice and behavior of Typhoid patients among the 289 Typhoid patients and following result was found.

- **Raw food consuming behaviour**

Among the 289 Typhoid patients, 232 (80.27%) were found consuming raw foods without proper washing, 40 (13.84%) with washing and remaining 17 (5.88%) directly from the source without cleaning.

- **Hand washing behaviour**

It was found that out of 289 Typhoid fever patients almost 65.35% (189) were found using water only to wash their hands, 13.15% (38) were found using ash-water and remaining 21.45% (62) with soap-water.

- **Water drinking behaviour**

Among the 289 Typhoid patients almost 80.62% (233) were found using the drinking water directly from the source, 11.07% (32) only after chemical treatment or boiling and rest 8.30% (24) generally used drinking water after boiling or filtering when the source becomes turbid especially during rainy season.

❖ **Interview with household heads**

Demographic discription

During the study period, interview was conducted through a set of structured questionnaire among 196 respondents of ward no. 7 of Dhangadi Municipality each from the randomly selected households comprising 102 (52.04%) females and 94(47.96%) males. The total no. of population in surveyed households was 1568; hence the population size of each household is 8.

Out of total (196) selected respondents, 23(24.46%) males and 22(21.57%) females of age group 15-30 year, 41(40.20%) females and 34(36.17%) males of age group 31-46 year, 36(35.29%) female and 28(29.78%) males of age group 47-62 years and 3(2.94%) females and 9(9.57%) males of age group above 63 years were selected for the interview (Table no. 7).

Table No.7: Age and sexwise population of interviewed respondents

S.N.	Age groups (in yrs.)	Male		Female		Total	
		No.	%	No.	%	No.	%
1	15 – 30	23	24.46	22	21.57	45	22.96
2	31 – 46	34	36.17	41	4.20	75	38.26
3	47 – 62	28	29.78	36	35.29	64	32.65
4	63and above	9	9.57	3	2.94	12	6.12
	Total	94	47.96	102	52.04	196	99.99

) Educational status of the respondents:

In the study area, maximum 158(80.62%) respondents were literate and rest 38(19.38%) were illiterate. Among the literate respondent 87(55.06%) had primary education, 24(15.19%) had lower secondary level, 28(17.72%) had secondary level and 19(12.02%) respondents had higher secondary and higher education (Table no. 8).

Table No. 8: Educational status of respondents

S.N.	Education status		No. of respondents	%	Total
1	Literate	Primary	87	55.06	158
		Lower Secondary	24	15.19	
		Secondary	28	17.72	
		Higher Sec. and Higher	19	12.02	
2	Illiterate		38	19.38	

) Behaviour/ practice of respondents about Typhoid fever

- **Knowledge of respondents regarding Typhoid fever**

The respondents who had no any knowledge regarding the symptoms, mode of transmission and preventive measures of Typhoid fever were found 124 (63.26%) and rest 72 (36.73%) had knowledge about symptoms, mode of transmission and preventive measures of Typhoid fever.

- **Views of people regarding the symptoms of Typhoid fever**

The study showed that the positive response of the respondents about the symptoms of Typhoid fever were; fever 39 (54.16%), intense headache 10 (13.88%), abdominal pain 6 (8.33%), Diarrhoea and loose stool 7 (9.72%), vomiting and Nausea 5 (6.94%) and Cough 5 (6.94%) (Table no. 9).

Table No.9: Views of respondents regarding the symptoms of Typhoid fever

S.N.	Symptoms	Positive response	%	Total no of respondents
1	fever	39	54.16	72
2	Intense headache	10	13.88	
3	Abdomen pain	06	8.33	
4	Diarrhoea + loose stool	07	9.72	
5	Vomiting + Nausea	05	6.94	
6	Cough	05	6.94	
	Total	72		

- **Views of respondents regarding the mode of transmission of Typhoid fever**

Out of the total 72 respondents who had knowledge about symptoms, mode of transmission and preventive measures of Typhoid fever, 16.66% (12) had knowledge that Typhoid fever transmits by consumption of contaminated food, 27.77% (20) said that Typhoid fever transmits by the consumption of contaminated water, 30.55% (22) by contaminated food and water, 8.33% (6) by consumption of contaminated milk, meat and their products, 16.66% (12) said all the above agents are responsible for the transmission of Typhoid fever (Table no.10).

Table No. 10: Views of respondents regarding the mode of transmission of Typhoid fever

S.N.	Mode of transmission	Positive response	Percentage (%)	Total
1	Contaminated food	12	16.66	72
2	Contaminated water	20	27.77	
3	Contaminated food and water	22	30.55	
4	Contaminated milk, meat and their products	06	8.33	
5	all of above	12	16.66	

- **Knowledge of respondents about the zoonotic nature of the Typhoid fever**

Out of 72 respondents, only 13(18.05%) had knowledge about the zoonotic nature of the Typhoid fever.

- **Raw food consuming behavior of the respondents**

Regarding the raw food consuming behaviour, it was found that 122 (62.24%) respondents were not aware about the transmission of diseases from the raw food consumption, out of which 50 (25.51%) respondents were consuming raw foods like carrot, radish, cucumber, water melon, fruits and other types of foods directly picking from the source, 72 (36.73%) after scrubbing and remaining 74 (37.75%) respondents were consuming raw foods only after washing well.

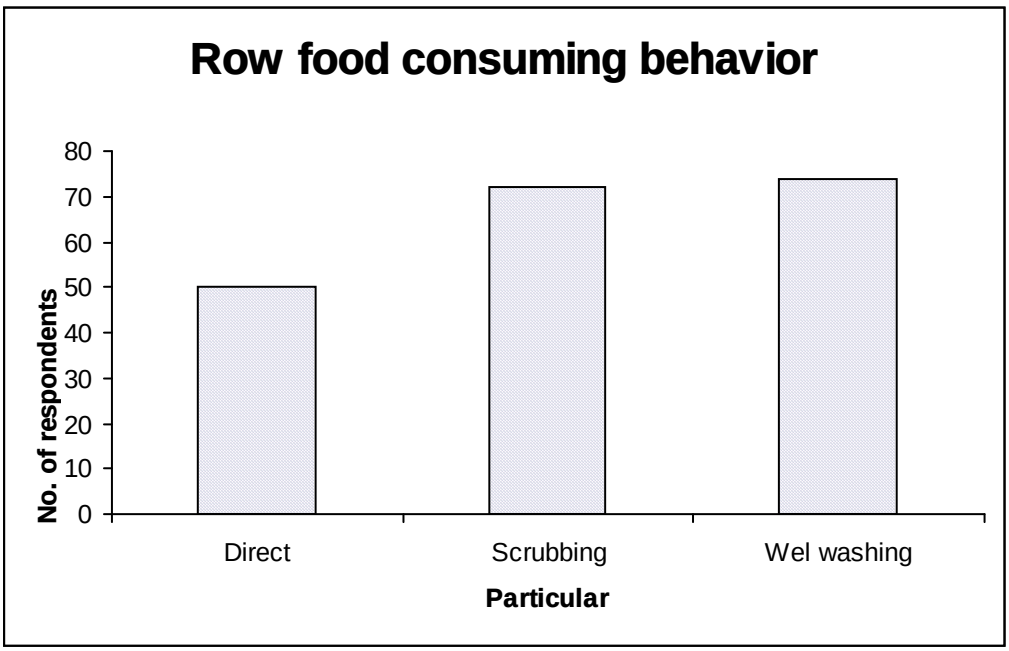

Fig.6: Graph showing raw food consuming behaviour of respondents

- **Hand washing behavior of respondents after defecation**

Due to the lack of knowledge and low economic status, most of the people of the rural area have not proper hand washing practice. Proper hand washing practice plays an important role in the controlling of Typhoid fever. In the survey area, most of the respondent 103 (52.55%) out of 196 respondents washed their hands with only water, 69(35.20) with soap, soda and water, and rest 24 (12.24%) with kharani (wood ash) and water after defecation.

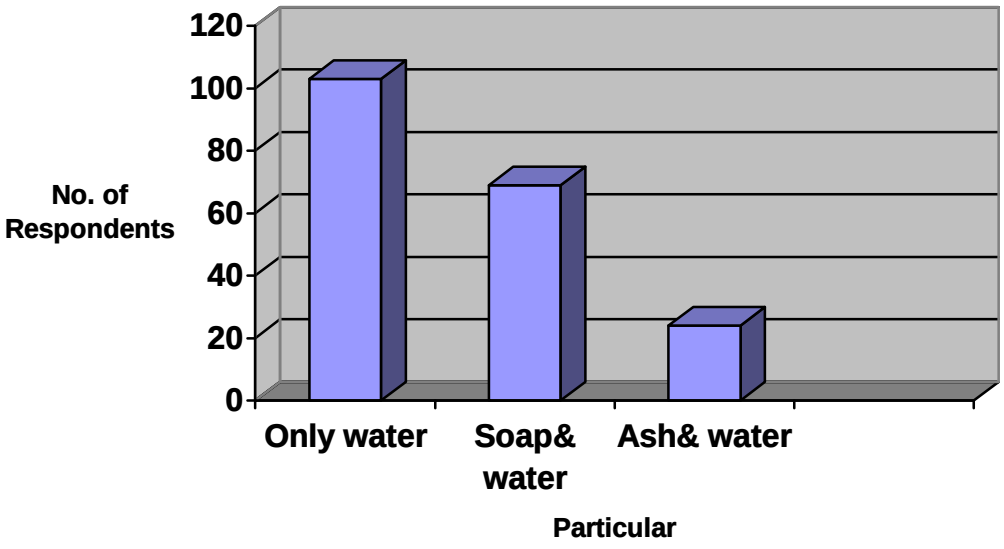

Fig.7: Graph showing Hand washing behavior of respondents after defecation

) Types of water source

In the study area, underground water is the main source of water which is used for all household activities including drinking water. Out of 196 respondents, 136(69.39%) were using tube well, 45(22.96%) respondents were using running water as well as tube well, remaining 15(7.65%) respondents were using spout water and tape water as a source of drinking water.

- **Sanitation of water source**

In the study area, it was found that 123 (62.75%) respondents were using the water sources with satisfactory sanitation i.e. clean water resource out of reach of cattle and children, 48(24.49%) with good sanitation i.e. neat and clean water resources located far from the toilet and remaining 25 (12.75%) were using the sources of water with poor sanitation i.e. not clean water resource having the chances of contamination by children and cattle.

- **Water treating practice of respondents**

In the study area, underground water was being used as a main source of water. It was found that 169 (86.12%) people using drinking water directly from the source, 10(5.10%) after boiling at the time of rainy season when source become turbid, a least number of people 5 (2.55%) after filtration and rest 12(6.122%) people were found using drinking water after chemical treatment (Table no. 11).

Table No. 11: Water treating practice of respondents

	Water treatment practice				Total
	No treatment	Boiling	Filtration	Chemical treatment	
No.of people (respondent)	169	10	05	12	196
Percentage %	86.22	5.10	2.55	6.12	99.99

) Types of latrine

In the study area, it was found that 151 (77.04%) respondents had latrines and rest 45 (22.96%) had no latrines and they were using open fields, bushes, road sides or stream banks for the defection. Out of 151 respondents who had latrines 84(42.86%) had water sealed cemented latrines, 25(12.75%) had temporary i.e. with temporary pit and roof and rest 42(21.43%) had pit latrines without roofing (Temporary latrines) (Table no. 12, Fig. 6).

Table No.12: Types of latrine in the surveyed area

S.N.	Types of latrines		Number	%
1	permanent or temporary latrine	water sealed	84	42.86
		Pit latrine	25	12.75
		Temporary	42	21.45
2	No latrine		45	22.96
Total			196	100

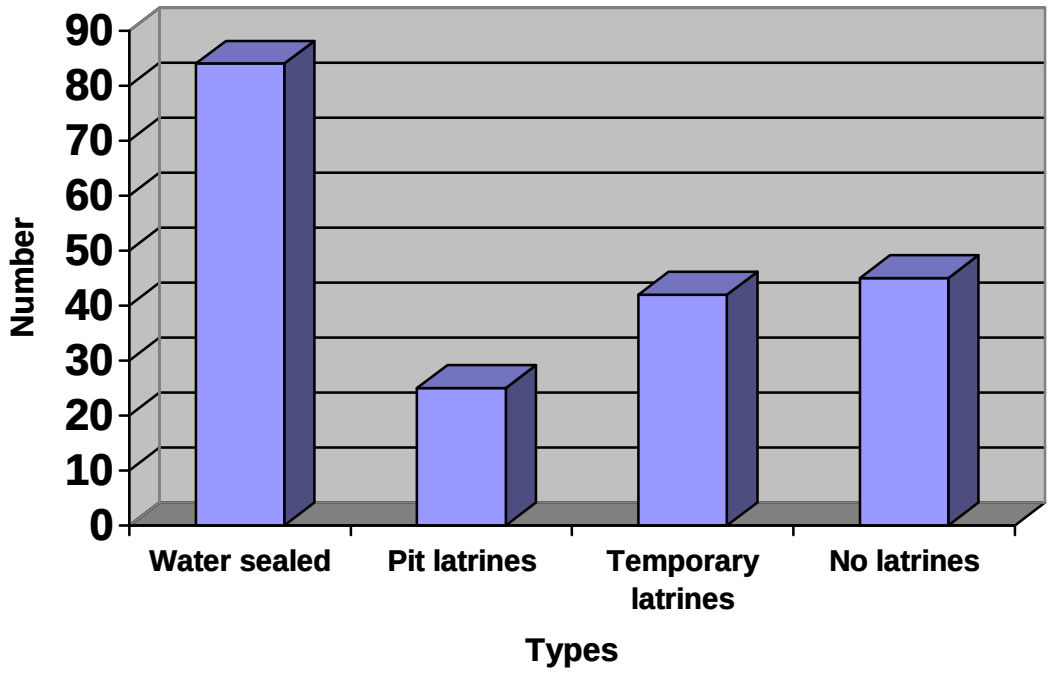

Fig.8: Graph showing types of latrines in the surveyed area

- **Distance of latrine from kitchen in the study area**

It was found that 163 (83.16%) had the latrine more than 10 meter apart and less than 20m apart from the kitchen, 31 (15.82%) had more than 5 meter apart and rest 2 (1.02%) had less than 2 meter apart from the kitchen.

- **Distance of latrine from the water source**

Out of 196 houselholds in the survey area, it was found that 129 (65.82%) house had latrines more than 10 meter apart, 53(27.04%) had more than five meter apart and 14 (7.14%) had less than two meter apart from the water sources.

VII

DISCUSSION AND CONCLUSION

The present study aimed to investigate the incidence of Tyhoid fever in Kailali district. To observe the incidence of Typhoid fever in human, during the study period, a total of 936 blood samples were collected from suspected patients of Typhoid fever having the symptoms like fever, headache, abdominal disorder, malaise etc. Out of total 936 collected blood samples, 519 samples were from males and 417 were from female. Out of total examined samples, 289(30.87%) samples were found to be positive for Typhoid fever. The sex wise incidence rate was 31.02% in male and 30.69% in female. This data ststistically revealed that there was insignificant difference between the gender and infection of Typhoid bacilli ($\chi^2 = 0.01$, $P<0.05$, d.f.1)

Present study showed the highest Typhoid cases among the age-group 10-29 yrs which is some what similar to the result revealed by the Tasyaram *et al*., (1996) and Velema *et al*., (1997) i.e. the highest incidence among the age groups 13-30 and 22 years respectively. Kulkarni *et al*., (1995) showed the different result in their study i.e. highest incidence among age-group 1-14 yrs and Kapadi, (2005) showed somewhat similar results to the present study i.e. 10- 19 years. It might be due to 10-30 years being the most active age-group, people mostly exposed to the contaminated environment in this age group. Some minor difference in the incidence might depend upon the difference in cultural, social practices, hygiene and sanitary condition of different countries etc. among these, none of the tyhoid cases were found above the age group of 70 yrs. The data of the present study ststistically revealed that there was

significant difference between the different age groups and infection of Typhoid bacilli ($\chi^2 = 12.52$, $P<0.05$, d.f.3)

The present study showed that the higher number of Typhoid cases were recorded in the month of May to August i.e. in spring ,summer and in rainy season which is almost similar to the result revealed by Saha *et al*., (2001) i.e. in monsoon and in summer season. Similarly Maguire *et al*., (1993) also showed the similar result i.e. highest no. of Typhoid cases in August. But Tasyaram *et al*., (1996) revealed the highest number of Typhoid cases in autumn. The Kapadi, (2005) also showed the somewhat similar result to the present study i.e. the highest number of Typhoid cases in the spring and in autumn.

Joshi, (2003) conducted a study upon different meat samples from ward no. 13 of Kathmandu Metropolitan City for the isolation and identification of *Salmonella* spp and isolated *Salmonella typhi* in 1.62% which shows that unhygienic consumption of meat is risky. She also reported high incidence of *Salmonella* in 18.0% raw meat samples in summer season. This result shows somewhat close relationship with the present study.

The highest incidence of Typhoid fever in May to August might be due to being the rainy and summer season by having maximum chance of water source contamination since almost all the water sources in the study area were without proper sanitation and about 86.22% people of that area were found drinking water without any treatment or it might be due to being the time of marriage ceremony and feast and festivals by having great chance of contamination of food and due to ice-cream consumption. The least cases of Typhoid fever were recorded in December and January i.e. winter season which might be due to being cold weather having less chances of water source contamination and hence less exposure of the people to the

infection. This data statistically revealed that there was significant difference between the attack of Typhoid bacilli with respect to different months of the year ($\chi^2 = 55.05$, $P<0.05$, d.f.11)

Typhoid fever remains a significant public health problem in Kailali district, which affects generally active age-groups of people. Two hundred and eighty nine patients were diagnosed on the basis of positive Widal test and were studied for clinical profile. The common symptoms were fever (100%) since fever was the main basis for the selection of patients for the study, intence headache (84.43%), abdomen pain(34.95%), diarrhoea and loose stool (40.83%), nausea/vomiting (29.76%) and cough (28.37%) to the suspected Typhoid patients. Similar symptoms were revealed by Kapadi, (2005) in his study among 51 Typhoid patients and recorded fever (100%), headache (76.47%), diarrhoea/loose stool (66.66%), nausea/vomiting (43.13%) and cough (19.60%) cases. Similar symptoms were also revealed by Kabra *et al*., (2000) in their study among 100 Typhoid patients and recorded fever 100% cases, vomiting 58%, abdominal pain 48%, cough 22% and loose stools in 14% cases. Similarly, Mishra *et al*., (1997) reported fever in (100%) patients, diarrhoea (77%) vomiting (50%) and dehydration in 30% patients in their study among 41 Typhoid patients. Menghous *et al*., (1997) found fever in 66.3%, rose-spots 32.6%, enlarged spleen and liver in 69.5% and leucopenia in 94.3% patients among 178 Typhoid patients.

Ethnic-group wise occurrance of Typhoid fever showed that the highest Typhoid fever cases were recorded among Dalits i.e. in 89 (30.79%) patients and the least occurrence in Bhramins i.e. 61(21.11%) where it was found 77(26.64%) in Chhetris followed by 62(21.45%) in Baishyas. The highest incidence of Typhoid observed in Dalits might be due to their low economic status so that they work in

field, exposed to infection and unaware about mode of transmission of Typhoid fever and in Bhramins it is found the least due to the awareness about mode of transmission of Typhoid fever. No literature regarding Typhoid fever in different ethnic group was found.

An analytical study was made to find out the knowledge, attitude and practice (KAP) of the tyhoid patients which showed that almost people were unaware about their safe feeding and drinking habit. Among 289 Typhoid patients, maximum i.e. 233(80.62%) were found using the drinking water without any treatment, 189(65.39%) were found using only water to wash their hands before eating and after using latrine and 80.27% were found consuming raw food without proper washing. This data clearly reveals that they had no any knowledge about the mode of transmission of disease since the contaminated water and foods are the main vehicles of transmission of Typhoid fever as described by Velema *et al*., (1997) and Luby *et al*., (1998) i.e. consuming raw foods, ice-creams and improper hand washing practices are main risks for the infection. The result showed that only a few patients were aware and were found taking the raw foods after cleaning properly.

The survey result of the study area also showed that among the total of 196 respondents, 63.26% had not any knowledge regarding the symptoms, mode of transmission, causative agent and preventive measures of Typhoid fever. It was also found that 55.06% respondents had primary level education and only 12.02% respondents had higher secondary and the higher education. About 19.38% respondents were found illiterate. This data clearly reveals the there is lack of knowledge regarding Typhoid fever among the people of that area. So, Typhoid fever might be prevalent due to the lack of proper knowledge about it.

Yew *et al*., conducted an epidemiological study of Typhoid fever in Singapore among 1452 patients of Typhoid fever and recorded the food as main vehicle of transmission. Similar studies were carried out by Khazenson, *et al*., (1996) in Russia and found that consumption of insufficiently cooked food was the main source of infection. Kulkarni, (1996) conducted similar study to investigate the cause of explosive nature of Typhoid fever among 1-14 year age groups and reported that the microbiological examination of water showed the evidence of faecal contact of water. Velema, *et al*., (1997) conducted a study to find out the sources of infection and routes of tramission of Typhoid fever in Indonesia and found that consumption of food from food stalls in the street and their hand-washing practice were strongly associated with the risk.

Since the infected food and water are the main sources of infection of Typhoid fever and consumption of such food and water is risky. The present study was conducted to evaluate the sanitary condition of water-sources, main types of water sources and practices of people for the treatment of water in the study area. The result showed that out of 196 respondents 69.39% were found using tube-well as the source of water, 22.96% respondents were using running water as well as tube-well and only 7.67% were using spout water or tap water as a source of drinking water. Out of 196 respondents, maximum 86.22% do not treat the drinking water. In the study area, it was also found that 22.96% people did not have latrine, 21.43% had temporary latrines which shows the unsatisfactory status of latrine. The water-sources were very close to the latrine and improper management of water sources and latrine shows that there may be great chance of contamination of the sources of water.

Hand-washing behavior of the infected patients also plays a vital role for the transmission of Typhoid fever as described by Velema *et al*., (1997) and Luby *et al*.,

(1998) i.e. improper behavior before eating food and after using latrine was the main cause for the infection of Typhoid fever in their studies. In the present study also hand-washing behaviour of the patients was found to be unsatisfactory. Out of 196 respondents, 52.55% were found washing their hands only with water whereas 35.20% with soap-water and soda-water and remaining 12.24% with ash (kharani) and water.

The study on the distance between kitchen and latrine revealed that most of the kitchens were at less than 20m apart from the latrine and similarly the latrines and water-sources were found less than 10m apart. This fact clears that there is maximum chance of contamination of food and water by different mechanical means.

The incidence rate of Typhoid fever was found 0.46 per thousand per year which is very much lower than that of the result revealed by Velema *et al*., (1997) and Yew *et al*., (1993) i.e. 3.1 and 1.2 respectively. The case fatality rate (C.F.R.) was found to be zero which showed somewhat good result dislike that of Carmeli *et al*., (1993) and Velema *et al*., (1997) i.e. 12-32% and 5.1% respectively.

VIII

RECOMMENDATIONS

- The present study was focused out in only one hospital and in small population of Kailali district because of fund limitation and time limitation. For better understanding about the incidence of Typhoid fever, further study should be done in several hospitals and in large population.
- Most of the people are unaware about the knowledge of Typhoid fever. The government should lunch the proper health education programme to enhance the knowledge of the people regarding causative agent, mode of transmission and preventive measure of various diseases.
- Clean and safe drinking water should be supplied in order to decrease the rate of Typhoid fever patients.
- Consuming raw foods without proper cleaning should be avoided to decrease the rate of Typhoid patients.
- Hygenic conditions of all foods, fruits and vegetables should be improved.
- Personal hygiene of people should be improved eg. proper cleaning of hands before taking food and after defecation should be practiced.
- Butchers and Meat-sellers should be trained for the better hygienic meat marketing technique.
- All the patients with signs and symptoms of Typhoid fever should be given an adequate course of an appropriate antibiotic and Typhoid vaccine should be introduced in the National Immunization Schedule to decrease the incidence of Typhoid fever.
- The street food were also found important mode of transmission of Typhoid fever. Hence, the food and beverages from street venders should be avoided to reduce the prevalence of Typhoid fever.

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Annex- 1(A)

Questionnaire for Typhoid Patient

	Fever	Yes/No
Name:	Intense headache	Yes/No
Address:	Diarrhoea /loose stool	Yes/No
Age:	Abdomen pain:	Yes /No
Sex:	Vomiting	Yes/No
	Cough	Yes/No

1. How long have you been down with fever?

   .....

2. How do you drink water?

   a) After boiling b) After filtration

   c) After chemical treatment d) Direct from water sources

2. When do you wash your hands?

   a) Only after and before meal b) Only after using toilet

   c) After working in fields d) Others.....

3. How do you eat raw food and vegetables?

   a) Without cleaning b) Scrubbing c) Cleaning with water d) Others…

Thank you

Annex-1(B)

Questionnaire for Household Heads

Name: **Address:**
Age: **Sex:**
Education:

1. Have you known about Typhoid fever?
   a) Yes b) No
   If yes, what are the symptoms of Typhoid fever?
   .....
2. Do you know about the mode of transmission of Typhoid fever?
   a) Yes b) No
   If yes, can you say about mode of transmission of Typhoid fever?
   .....
3. Food, water and animals can transmit diseases to human beings.Do you know about this?
   a) Yes b) No
   If yes, can you tell the name of the disease?
   .....
4. How do you eat raw food and vegetables?
   a) Without cleaning (Direct) b) Scrubbing c) Cleaning with water d) Others...

5. From which source do you drink water?
a) Well b) Tap (Spout) c) Tube-wells c) Others....

6. How do you drink water?
   a) After boiling b) After filtration
   c) After chemical treatment d) Direct from water sources

7. What type of toilet have you made?
   a) Water sealed b) Pit latrine c) Temporary latrine d) Others.....
   If no, where do you go for defecation?
   a) At open fields b) Stream banks c) Bushes d) surrounding the house

8. What do you use to wash your hands after using toilet?
   a) Only water b) Soap water c) Kharani pani d) others.....

9. Sanitation of water source:
   a) Good b) Better c) Best c) Poor

10. Distance between toilet and source of water
    .....
11. Distance between kitchen and toilet
    ……

Than you

Annex- 2

Significance test between different age groups and attack of Typhoid bacilli

Table No I. Results of the laboratory(Age-wise distribution of Suspected cases (Typhoid positive and negative cases)

Age groups	Typhoid cases		Total suspected Cases
	positive cases	Negative cases	
Below 19	135	270	405
20-39	122	250	372
40-59	29	98	127
60- above	3	29	32
Total	289	647	936

Null hyphothesis (H_0): There is no significant difference between the different age groups and the attack of the Typhoid bacilli.

Alternative hyphothesis (H_1): There is significant difference between the different age groups and the attack of the Typhoid bacilli.

Calculation:-

S.no.	Observed frequency(O)	Expected frequency(E)	(O-E)	$(O-E)^2$	$\chi^2 = (O-E)^2/E$
1.	135	125.04	9.95	99.00	0.79
2.	122	114.85	7.14	50.98	0.44
3.	29	39.21	-10.21	104.24	2.65
4.	3	9.88	-6.88	47.33	4.79
5.	270	279.95	-9.95	99.00	0.35
6.	250	257.14	-7.14	50.98	0.19
7.	98	87.78	10.22	104.45	1.18
8.	29	22.12	6.88	47.33	2.13
Total					$\chi^2 = 12.52$

Thus, the computed value of $\chi^2 = 12.52$.

The above table no.(I) contains four rows and two columns; it is a 4×2 contingency table. For such contingency table,

The degree of freedom (d.f.) =(c-1) ×(r-1) = (4-1) × (2-1) =3

The tabulated value of χ^2 with 3 d.f. at 95% confidence level is 7.81.

Since the calculated χ^2 i.e. 12.52 is much greater than the tabulated χ^2 at 95% confidence level for 3 d.f. i.e. 7.81, it is significant and the alternative hypothesis is accepted which means that there is significant difference between the different age groups and attacks of Typhoid bacilli.

Annex-3

Significance test between gender and attack of Typhoid bacilli

Table No.II: The results of the laboratory (Gender-wise distribution of suspected cases (Typhoid positive and negative cases).

Gender	Typhoid positive cases	Typhoid negative cases	Total suspected cases
Male	161	358	519
Female	128	289	417
Total	289	647	936

Null hyphothesis (H_0): The gender and the infection of Typhoid bacilli are not associated in Kailali district.

Alternative hyphothesis (H_1): The gender and the infection of Typhoid bacilli are associated in Kailali district.

Calculation:-

S.no.	Observed frequency(O)	Expected frequency(E)	(O-E)	$(O-E)^2$	$(O-E)^2/E$
1.	161	160.24	0.75	0.567	0.003
2.	128	128.75	-0.75	0.567	0.004
3.	358	358.75	-0.75	0.567	0.001
4.	289	288.24	0.75	0.567	0.002
Total					$\Sigma(O-E)^2/E=0.01$

Hence, the computed χ^2 is 0.01.

From the above table ,the degree of freedom(d.f.)= $(c-1)\times(r-1)=(2-1)\times(2-1)=1$

The tabulated value of χ^2 at 95% confidence level for 1 d.f. is 3.84.

Since the calculated χ^2 i.e. 0.01 is less than the tabulated χ^2 at 95% confidence level for 1 d.f. i.e. 3.84, it is insignificant and the null hypothesis is accepted which means that the gender and the infection of Typhoid bacilli are not associated in Kailali district.

Annex-4

Significance test between Months and attack of Typhoid bacilli

Table No.III: The results of the laboratory (Month-wise distribution of suspected cases (Typhoid positive and negative cases).

S.N.	Months	Typhoid positive cases	Typhoid negative cases	Total
1	June	32	49	81
2	July	46	67	113
3	August	54	74	128
4	September	28	69	97
5	October	18	58	76
6	November	7	44	51
7	December	4	38	42
8	January	3	29	32
9	February	10	47	57
10	March	18	65	83
11	April	29	52	81
12	May	40	55	95
Total		289	647	936

Null hypothesis (H_0): There is no significant difference between the attacks of Typhoid bacilli and the different months of the year.

Alternative hypothesis (H_1): There is significant difference between attacks of Typhoid bacilli and the different month of the year.

Test statistic:

Under Ho, the test statistic is $\chi^2 = \frac{\Sigma (0-E)^2}{E}$

From the above table the computed χ^2 is found to be 55.05.

Degree of freedom= (c-1) ×(r-1) = (2-1) × (12-1) =11

The tabulated value of χ^2 at 95% confidence level for 11 d.f. is 19.67.

Conclusion:

Since the calculated χ^2 i.e. 55.05 is much greater than the tabulated χ^2 at 95% confidence level for 11 d.f. i.e. 19.67, it is significant and the alternative hypothesis is accepted which means that there is significant difference between attacks of Typhoid bacilli and the different month of the year.