

Knowledge Attitude and Practices about Typhoid Fever in Adolescents and Adults of Islamabad Pakistan: A Cross-Sectional Study

Bisma Tariq¹, Haroon Ahmed¹, Shumaila Naz².

¹Department of Biosciences, COMSATS University Islamabad, Pakistan.

²Department of Biological Sciences, National University of Medical Sciences (NUMS), Rawalpindi, Pakistan.

ORIGINAL ARTICLE

ABSTRACT

Received on: December 30, 2024.

Accepted on: January 28, 2025.

Published on: January 31, 2025.

Keywords: Fever;
Food safety;
Knowledge;
Hygiene practices;
Pakistan;
Typhoid.

Corresponding author: Bisma Tariq
bismatariq2025@hotmail.com

Background: Typhoid fever, caused by *Salmonella Typhi*, is a major public health challenge in Pakistan, predominantly due to inadequate sanitation and contaminated food and water. While significant strides have been made in disease surveillance and hygiene promotion, gaps persist in public knowledge, attitude and practice (KAP) regarding its prevention and management.

Objective: The study aimed to assess the knowledge, attitude and practices about typhoid fever in adolescents and adults living in Islamabad.

Methods: A community-based cross-sectional study was conducted from September to December 2020, involving 283 participants aged 15 and above. Data were collected through structured questionnaires encompassing socio-demographics, knowledge, attitude and hygiene practices. Statistical analyses were performed using SPSS to identify correlations between variables.

Results: Most respondents (93.3%) were aware of typhoid fever, yet only 63.3% understood its transmission routes. Hygiene practices were high, with 94.7% acknowledging the role of handwashing in food safety. However, gaps were noted in food handling behaviors, such as sanitizer usage (35.7%). Positive attitudes toward prevention were reflected by 92.2% of participants emphasizing proper cooking methods. Statistical analysis highlighted significant associations between hygiene practices and disease prevention.

Conclusion: Despite high awareness and generally positive attitudes, inconsistencies in preventive practices underscore the need for enhanced public health education focusing on proper hygiene and food safety. Strengthening surveillance and targeted interventions could further reduce the burden of typhoid fever in Pakistan.

Citation: Tariq B, Ahmed H, Naz S. Knowledge attitude and practices about typhoid fever in adolescents and adults of Islamabad Pakistan: A cross-sectional study. Chron Biomed Sci. 2025;2(1):40. Available from: <https://cbsciences.us/index.php/cbs/article/view/40>.

Introduction

Typhoid fever, a severe epidemic associated with fever, is caused by *Salmonella enterica serovar Typhi*, a gram-negative bacterium. This pathogen invades the body and colonizes macrophages in the reticuloendothelial system, starting from the small intestines and entering the bloodstream. Infection generally occurs through the ingestion of contaminated food or water, often originating from poor hygiene or bacterial contamination

of water supplies. Despite the introduction of hygiene education programs and hand-washing facilities to control the spread, the infection continues to persist [1]. Typhoid fever remains widespread, affecting both developed and developing nations. The evolving nature of infectious strains, influenced by socio-economic and environmental factors, places significant strain on public health [2]. Measuring the prevalence of typhoid fever in young children is crucial for determining the appropriate

immunization schedules and vaccine options for public health initiatives. Hospital-based studies suggest that children under five may not require the typhoid vaccine, but this viewpoint should be revisited through community-based clinical trials [3].

Globally, typhoid fever remains a major health burden, with an estimated 16 million infections and 600,000 deaths annually. However, the true extent of the disease burden is not fully understood in many countries due to limited resources. The original global burden estimates, published in 1986, had several limitations, including the exclusion of data from China and a lack of details on the methodology used [4]. Advances in surveillance, improvements in water and sanitation, and a better understanding of the disease's age distribution have made it possible to refine these estimates. Contemporary approaches to measuring disease burden, including population-based studies and vaccine research, offer a more accurate picture of typhoid fever's global impact [5][6]. The Global Burden of Disease (GBD) 2017 report highlighted the importance of evaluating typhoid fever's geographical spread and impact, providing updated estimates to better inform global public health strategies.

A series of studies have highlighted varying levels of knowledge, attitudes, and practices regarding typhoid fever in different communities. In a Burundian refugee camp, Nahimna et al. found that while over half of respondents had heard of typhoid fever, knowledge about transmission and prevention was low, with only 34.6% and 38.6% knowing how the disease spreads and how to prevent it [1]. This study aims to assess the community's awareness and behaviors surrounding typhoid fever in Rawalpindi and Islamabad, which will help identify gaps in knowledge and hygiene practices. The findings will inform targeted interventions and public health strategies to reduce the burden of typhoid fever in these cities.

Methods

The selected region for this survey includes the twin cities of Pakistan, Rawalpindi and Islamabad, along with their surrounding districts. Rawalpindi, located at latitude 33.626057 and longitude 73.071442, lies at an altitude of 508 meters, making it the largest city in northern Pakistan. It is a bustling metropolis situated near Islamabad, forming part of the Islamabad-Rawalpindi metropolitan area. Islamabad, on the other hand, is situated at 33.43°N and 73.04°E at the northern edge of the Pothohar Plateau, with the Margalla Hills

rising in the background. Its elevation is 540 meters. These cities are highly developed and densely populated, with diverse ethnic groups, including Punjabis, Pathans, Sindhis, and many others. The general public targeted in this study comprises both urban and rural populations from these cities and their nearby villages. The rural population tends to consume home-cooked food but often neglects proper hygiene practices, whereas the urban population is more inclined to buy ready-to-eat food. However, poor sanitation and hygiene practices contribute significantly to the prevalence of typhoid fever in the region.

The study was conducted over a four-month period, from September to December 2020, to gather data on the prevalence of typhoid fever and the associated risk factors. The study adopted a community-based cross-sectional design to assess the knowledge, attitudes, and practices (KAP) related to typhoid fever among residents of these areas. The data collection method involved face-to-face interviews and an online survey, using a structured and pretested questionnaire. The questionnaire focused on a range of topics, including respondents' knowledge of typhoid fever, their attitudes towards prevention and treatment, and their hygiene practices. Both qualitative and quantitative data were collected to assess the public's awareness and practices, as detailed in previous studies [1].

A total of 283 questionnaires were completed, with participants aged 15 years and above from Rawalpindi and Islamabad, as well as their respective districts. The study collected anonymous responses from a diverse demographic, capturing various socio-economic factors. The questionnaire was designed to gather data on socio-demographic characteristics, as well as participants' knowledge of typhoid fever, attitudes towards prevention and treatment, and their practices, particularly in relation to hand washing and the use of sanitation facilities. In total, the questionnaire comprised 72 questions, including 17 questions on knowledge, 23 questions on attitudes, 21 questions on practices, and 11 questions on socio-demographic characteristics.

Data analysis was conducted using MS Excel, and frequencies were calculated to interpret the results. Chi-square analysis (χ^2) was performed using SPSS software to evaluate the relationship between independent variables, such as age, gender, occupation, and ethnicity, and the dependent variables, including knowledge, attitude, and practices related to typhoid fever. The study aimed to identify the factors associated with the spread of typhoid fever, focusing on how well individuals

understood the disease and whether they engaged in preventive measures such as hand washing and using sanitary facilities. The study variables included both independent variables (e.g., gender, age, income) and dependent variables (e.g., knowledge about typhoid fever, attitudes towards exposure, and practices related to prevention).

Results

Sociodemographic background of study population: The study involved 283 participants from the twin cities of Pakistan, targeting the general population with a wide age range (15 to above 55 years). Among the respondents, 61.8% were female and 38.2% were male. The majority of participants were Punjabi (51.2%), with others from diverse ethnic backgrounds, including Pathan, Kashmiri, and Urdu-speaking groups. The sample was highly educated, with 50.7% having a bachelor's degree. Most participants were married (100%) and lived in urban areas (87.6%). The largest occupational group was from office-based jobs (27.2%), while a significant portion (69.9%) worked in various other fields. Income levels varied, with 56.2% earning above 30,000 PKR monthly, and most were employed as civilians (88%).

Knowledge about typhoid fever: The survey revealed high awareness of typhoid fever, with 93.3% of respondents having heard of the disease. However, knowledge about its transmission was less comprehensive, as only 63.3% were aware that it spreads through contamination. Antibiotic use was varied, with most knowing that Azithromycin is used, while a substantial portion was unsure. Water quality was also a concern, with 93.6% of respondents acknowledging its impact on health, and 58.3% preferred combination antibiotic therapy for typhoid fever. The knowledge regarding transmission through food was mixed, and most participants understood the importance of hygiene practices, such as hand washing before meals, in preventing food contamination.

Attitude towards typhoid fever: The attitude of participants towards managing typhoid fever demonstrated that 91.5% routinely measured body temperature using a thermometer during a fever examination, and 64.3% regularly checked pulse rates. Hygiene practices were well-regarded, with 93.6% ensuring their knives were clean before and after use, and 92.2% believing that well-cooked food is safe from

contamination. While 45.2% considered abdominal inspection necessary for diagnosing typhoid, a large majority (94.7%) understood the importance of washing hands to reduce food contamination risk. Knowledge about salmonella and the role of freezing in killing bacteria was present in a significant portion of respondents, indicating generally positive attitudes toward preventing foodborne illnesses.

Table 1: Frequency of socio-demographic features

	Variables	n	%
Age (years)	≤25	199	70.3
	26-55	72	25.5
	>55	12	4.2
Gender	Female	175	61.8
	Male	108	38.2
Ethnicity	Punjabi	145	51.2
	Sindhi	1	0.4
	Pathan	24	8.5
	Urdu Speaking	61	21.5
	Kashmiri	33	11.7
Religion	Others	19	6.7
	Muslim	283	100.0
Married Status	Non-Muslim	0	0
	Married	64	22.6
	Single	218	77.0
	Separated	0	0
Occupation	Divorced	1	0.4
	Office	74	27.2
	Restaurant	3	1.1
	Banquet Hall	5	1.8
	Bar	0	0
Residence	Bakery	0	0
	Others	190	69.9
	Urban	248	87.6
Family Size	Rural	35	12.4
	Less than 5	76	26.9
	5-10	188	66.4
Monthly Income (PKR)	More than 10	19	6.7
	< 10,000	45	15.9
	10,000-20,000	37	13.1
	21,000-30,000	42	14.8
Education	> 30,000	159	56.2
	Non	12	4.4
	Middle/Elementary	2	0.7
	Matriculation	14	5.1
	Intermediate	59	21.7
Education	Bachelors	138	50.7
	Masters	43	15.8
	Ph.D.	4	1.5

Table 1: Knowledge about typhoid fever among respondents

Variables	Response	n	%
Heard about typhoid fever?	Yes	264	93.3
	No	19	6.7
Source of information about typhoid fever?	Health workers	32	11.3
	Media	195	68.9
	Community meeting	56	19.8
Knowledge of how typhoid fever is transmitted?	Yes	179	63.3
	No	104	36.7
Do you prefer to use combination of antibiotic in typhoid fever?	Yes	165	58.3
	No	118	41.7
Seeks medical assistance when sick?	Yes	261	92.2
	No	22	7.8
Which type of water is preferred during typhoid fever?	Water guard	37	13.1
	Boiling	189	66.8
	Aqua tablets	22	7.8
	None	35	12.4
Do you think quality of water can affect health?	Yes	265	93.6
	No	9	3.2
	I don't know	9	3.2
Do you think the water you use is safe for drinking?	Yes	213	75.3
	No	34	12.0
	I don't know	36	12.7
Do you think typhoid fever can be transmitted by food?	Yes	166	58.7
	No	117	41.3
Washing hands before work reduce the risk of food contamination?	Yes	268	94.7
	No	15	5.3
Drinking at the work place increase the risk of food contamination?	Yes	159	56.2
	No	53	18.7
	I don't know	71	25.1
Typhoid fever can be transferred from person to person?	Yes	89	31.4
	No	128	45.2
	I don't know	66	23.3
Washing utensils with detergent leaves them free of contamination?	Yes	178	62.9
	No	32	11.3
	I don't know	73	25.8
Salmonella is among the food-borne pathogens?	Yes	183	64.7
	No	100	35.3
Freezing kills all the bacteria that may cause food-borne illness (typhoid fever)	Yes	94	33.2
	No	55	19.4
	I don't know	134	47.3

[Table 1](#) shows various food handling practices that influence the risk of typhoid fever. A majority of respondents were aware of the importance of thorough cooking (78.8%), proper hand hygiene (90.5%), and wearing protective gear such as masks (75.3%) and gloves (85.5%) to reduce contamination. However, knowledge about hand washing before handling food was less common, with 66.1% unaware of its link to preventing typhoid. Statistical analysis revealed

significant associations between practices such as washing hands, wearing appropriate clothing, and the prevention of foodborne diseases, with p-values indicating strong correlations in most cases.

Table 3: Attitude towards typhoid fever among respondents

Variables	Response	n	%
Do you measure temperature with thermometer during exam of fever patient?	Yes	259	91.5
	No	24	8.5
Do you count pulse rate of fever patient routinely?	Yes	182	64.3
	No	101	35.7
Beards could contaminate food with foodborne pathogens?	Yes	174	61.5
	No	109	38.5
Do you have separate cutting boards for raw food and for cooked food?	Yes	174	61.5
	No	109	38.5
Do you have ensured that your knives are clean before and after usage?	Yes	265	93.6
	No	18	6.4
Do you inspect abdomen to find rose spots in a suspected patient?	Yes	128	45.2
	No	155	54.8
Well-cooked food is free of contamination?	Yes	261	92.2
	No	22	7.8
Perceived typhoid as a serious disease	Yes	249	87.9
	No	34	12.0
Washing hands before handling food leads to typhoid	Yes	96	33.9
	No	187	66.1
Raw and cooked foods should be stored separately to reduce the risk of food contamination?	Yes	255	90.1
	No	28	9.9
Cooking food thoroughly can prevent typhoid fever	Yes	223	78.8
	No	60	21.2
Appropriate water storage can prevent typhoid fever	Yes	151	53.3
	No	10	3.5
	May be	122	43.1
Where do you store drinking water?	Open container	54	19.1
	Closed container	229	80.9
Do you think of relative Brady/tachycardia in a fever patient?	Yes	53	18.7
	No	52	18.3
	May be	178	62.9
Do you palpate abdomen to note caecal gurgling in a suspected typhoid patient?	Yes	46	16.3
	No	45	15.9
	May be	192	67.8
Wearing caps and adequate clothing is an important practice to reduce the risk of food contamination	Yes	208	73.5
	No	75	26.5
Wearing mask is an important practice to reduce the risk of food contamination	Yes	213	75.3
	No	70	24.7
Proper hand hygiene can prevent food-borne diseases?	Yes	256	90.5
	No	27	9.5
Wearing gloves is an important practice to reduce the risk of food contamination?	Yes	242	85.5
	No	41	14.5
Long and finger painted nails could contaminate food with food-borne pathogens?	Yes	243	85.9
	No	40	14.1
It is necessary to check the temperature of refrigerators/freezers periodically to reduce the risk of food contamination	True	226	79.9
	False	57	20.1
The health status of workers should be evaluated before employment	Yes	251	88.7
	No	32	11.3
Safe food handling is an important part of my job responsibilities	Yes	237	83.7
	No	46	16.3

Table 4: Practices towards typhoid fever among respondents

Variables	Response	n	%
Do you wash hands before eating?	Always	192	67.8
	Most of the time	91	32.2
Do you wash hands after toilet?	Always	274	96.8
	Most of the time	9	3.2
Do you work when you have cold?	Yes	148	52.3
	No	135	47.7
Do you clean food contacts surfaces before and after preparing food?	Yes	268	94.7
	No	15	5.3
Do you drink raw milk?	Yes	60	21.2
	No	223	78.8
Do you eat half cooked meat?	Yes	30	10.6
	No	210	74.2
	May be	43	15.2
Do you usually have ready-to eat -food?	Yes	130	45.9
	No	76	26.8
	May be	77	27.2
Do you prepare food yourself or have ready to eat food?	Prepared yourself	154	54.4
	Ready to eat	129	45.6
	Well	42	14.8
What is the main source of drinking water?	Water reservoir	30	10.5
	Filter water	165	58.3
	Boiled water	46	16.3
	Well water	95	33.6
What are the main water sources for domestic use?	Municipal water	97	34.3
	Borehole water	91	32.2
	Yes	130	45.9
Do you have half cooked egg?	No	104	36.7
	May be	49	17.3
	Yes	101	35.7
Do you use the sanitizer when washing fruits?	No	182	64.3
	Yes	256	89.4
Do you properly clean the food storage areas before storing new products?	No	27	9.5
	Yes	172	60.7
Do you use the sanitizer when washing service utensils?	No	111	39.2
	Yes	31	10.9
Do you wear nail polish when handling food?	No	193	68.2
	May be	59	20.8
	Yes	206	72.8
Do you eat or drink at your work place?	No	77	27.2
	Yes	226	79.8
Do you wash your hands properly before or after using gloves?	No	57	20.1
	Yes	174	61.5
Do you wear a mask when you distributed unwrapped food?	No	109	38.5
	Yes	112	39.6
Do you prepare meal in advance?	No	75	26.5
	May be	96	33.9
	Yes	188	66.4
Do you use gloves during the distribution of unpacked food?	No	95	33.6

[Table 2](#) examines participants' actual practices related to typhoid fever prevention. A high percentage of respondents (96.8%) washed their hands after using the toilet, while 67.8% washed hands before eating. However, fewer respondents adhered to proper hygiene practices like using sanitizer when washing fruits (35.7%) or eating half-cooked food (10.6%). A majority (94.7%) cleaned food contact surfaces before and after preparation, and 21.2% drank raw milk, indicating differing levels of hygiene practices among respondents. Statistical analysis found significant associations with practices such as handwashing and the use of sanitizers, although some practices, such as drinking raw milk or eating half-cooked meat, were more variable.

[Table 3](#) explores respondents' attitudes towards typhoid fever and food safety. A significant portion of participants understood the importance of temperature measurements and cleanliness in preventing typhoid fever, such as using separate cutting boards for raw and cooked foods (61.5%) and wearing appropriate clothing (73.5%). The majority perceived typhoid as a serious disease (87.9%) and were aware of preventive measures like cooking food thoroughly (78.8%). Statistical tests confirmed significant relationships between attitudes about hygiene practices and foodborne disease prevention, such as washing hands before handling food ($p=0.004$) and ensuring workers' health status is evaluated ($p<0.00001$).

Finally, [Table 4](#) assesses the relationship between knowledge and actual practices in typhoid prevention. Most respondents regularly washed hands before eating (67.8%) and after using the toilet (96.8%), with significant associations between these practices and the prevention of foodborne diseases. However, attitudes toward handling raw food, such as eating half-cooked meat or drinking raw milk, were less consistent, with a notable proportion (21.2%) consuming raw milk. Statistical analysis revealed that practices like wearing gloves (66.4%) and masks (61.5%) were common, and knowledge of using sanitizers was linked to safer food handling.

Despite some variation, the data emphasizes the importance of safe food practices and the link between knowledge and behavior.

Discussion

Typhoid fever, caused by the *Salmonella typhi* bacteria, is a potentially life-threatening disease primarily transmitted through contaminated food and water. In developing nations like Pakistan, typhoid fever remains

a significant public health issue. In Pakistan, the high prevalence of typhoid fever is likely linked to factors such as illiteracy, poverty, overcrowding, inadequate sanitation, and insufficient access to clean drinking water [\[7\]](#). While environmental factors are typically linked to the disease, the higher prevalence in younger individuals may be related to immunological factors rather than environmental causes. As children grow, their exposure to *S. typhi* may result in lower incidence, but the immune mechanisms involved are not well understood. Additionally, poor hygiene and housing conditions have been suggested as household factors that increase the risk of typhoid fever, although no statistically significant associations were found for other household variables, except for population density [\[8\]](#).

Pakistan, with a population of around 210 million people, faces challenges due to its low socio-economic status and high population density, particularly in rural and overcrowded urban areas with inadequate sanitation. Research on KAP regarding typhoid fever in Pakistan's twin cities has been minimal, and this study aims to assess the prevalence of typhoid fever and conduct a KAP analysis.

In the study, various socio-demographic factors were considered, including age, gender, religion, ethnicity, education, marital status, occupation, and income, all of which had a significant impact on the spread of typhoid fever in Pakistan's twin cities. Age was found to be a contributing factor in the overall models for determining knowledge and perceptions about typhoid fever. The findings showed that most participants (70.0%) were between the ages of 15-25, similar to findings in Ethiopia, where 72.6% of participants were aged 17-22 [\[9\]](#). The majority of participants (61.8%) were female, which aligns with similar research in Malaysia [\[10\]](#), where 75.5% of participants were female. Conversely, a study in Fiji [\[11\]](#) reported a lower frequency of males (49%).

Regarding marital status, only 22.6% of participants were married, while previous studies in Ghana [\[12\]](#) reported a higher percentage of married participants (68.5%). Knowledge of typhoid fever varied according to educational background, with individuals holding a graduate degree demonstrating greater awareness. However, education played a crucial role in the prevention and control of typhoid fever.

Concerning knowledge about typhoid fever, the study revealed that 93.3% of respondents were aware of the disease, similar to findings in Lagos, Nigeria [\[13\]](#), where 90% had heard of typhoid fever. The majority of

participants expressed a willingness to seek medical help when sick [11]. In terms of food contamination, 56.2% of participants believed that drinking at the workplace increased the risk of contamination, aligning with findings from Bangladesh, where 61% thought the same. While most participants understood that typhoid fever could be transmitted through contaminated food (58.7%), knowledge on transmission methods was still incomplete [14].

Regarding attitudes toward typhoid fever, the study showed that 83.7% of participants agreed that safe food handling was a crucial part of their job, similar to findings in Malaysia, where 81.5% agreed [15]. Additionally, 91.5% of participants used a thermometer to measure the temperature of fever patients, higher than the 55.9% observed in India [16]. Although the overall attitude towards typhoid fever was positive, with high prevention practices, the use of home remedies was lower than expected. Further education on the disease and its transmission is necessary, along with guidance on effective prevention methods.

In terms of practices, the study found that 62.8% of participants always washed their hands before eating, and 32.2% washed their hands most of the time. This contrasts with a study in Uganda [17], where 90.7% of participants reported washing their hands before eating to prevent typhoid fever. Regarding work during illness, 52.3% of participants continued working while sick, which differs from a study in India [18], where 63.3% of participants worked despite having a cold. The majority of participants (96.8%) reported washing their hands after using the toilet, consistent with findings in South Africa [19]. The majority of respondents also washed fruits before eating them, citing the removal of bacteria and dirt as reasons for doing so. The study also found that 14.8% of participants were aware that wells are a primary source of drinking water, while 58.3% knew that filtered water was the main source, in contrast to findings in Congo [20], where fewer participants were aware that wells are a key source of drinking water.

Conclusion

The study found that knowledge about typhoid fever was high, attitudes were positive, and practices were moderate among participants. Given the emerging trend of typhoid fever in Pakistan, it is crucial to increase awareness and conduct comprehensive surveillance to control the disease's spread. Further research is necessary to explore typhoid fever in more detail, both in the study area and in other regions of Pakistan.

Authors' contributions

ICMJE criteria	Details	Author(s)
1. Substantial contributions	Conception, OR	1
	Design of the work, OR	1
	Data acquisition, analysis, or interpretation	2,3
2. Drafting or reviewing	Draft the work, OR	1,2
	Review critically for important intellectual content	3
3. Final approval	Approve the version to be published	1,2,3
4. Accountable	Agree to be accountable for all aspects of the work	1,2,3

Acknowledgement

None

Funding

This research study received no specific grant from any funding agency.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The Ethics Committee of COMSATS University Islamabad approved the study. Before distributing the questionnaire, all participants gave their written consent, and participant confidentiality is rigorously upheld for the whole study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

References

- [1]. Nahimana MR, Ngoc CT, Olu O, Nyamusore J, Isiaka A, Ndahindwa V, et al. Knowledge, attitude and practice of hygiene and sanitation in a Burundian refugee camp: implications for control of a Salmonella typhi outbreak. *Pan Afr Med J.* 2017;28:54.
- [2]. House D, Bishop A, Parry C, Dougan G, Wain J. Typhoid fever: pathogenesis and disease. *Curr Opin Infect Dis.* 2001;14(5):573-8.
- [3]. Sinha A, Sazawal S, Kumar R, Sood S, Reddaiah VP, Singh B, et al. Typhoid fever in children aged less than 5 years. *Lancet.* 1999;354(9180):734-7.

- [4]. Antillón M, Warren JL, Crawford FW, Weinberger DM, Kürüm E, Pak GD, et al. The burden of typhoid fever in low-and middle-income countries: a meta-regression approach. *PLoS Negl Trop Dis*. 2017;11(2):e0005376.
- [5]. Obaro SK, Iroh Tam PY, Mintz ED. The unrecognized burden of typhoid fever. *Expert Review of Vaccines*. 2017;16(3):249-60.
- [6]. Crump JA. Progress in typhoid fever epidemiology. *Clin Infect Dis*. 2019;68(Suppl 1):S4-9.
- [7]. Rasul F, Sughra K, Mushtaq A, Zeeshan N, Mehmood S, Rashid U. Surveillance report on typhoid fever epidemiology and risk factor assessment in district Gujrat, Punjab, Pakistan. *Biomed Res*. 2017;28(8):1-6.
- [8]. Khan MJ, Mian AM, Khurshid MS. Knowledge, attitude & practice among the food handlers of Bahawal Victoria Hospital, BWP. *Ind American J Pharm Sci*. 2018;5(6):6174-9.
- [9]. Gebreyessus GD, Adem DB. Knowledge, attitude, and practice on hygiene and morbidity status among tertiary students: the case of Kotebe Metropolitan University, Addis Ababa, Ethiopia. *J Envir Pub Heal*. 2018;2018(1):2094621.
- [10]. Zain MM, Naing NN. Sociodemographic characteristics of food handlers and their knowledge, attitude and practice towards food sanitation: a preliminary report. *Southeast Asian J Trop Med Public Health*. 2002;33(2):410-7.
- [11]. Prasad N, Jenkins AP, Naucukidi L, Rosa V, Sahu-Khan A, Kama M, et al. Epidemiology and risk factors for typhoid fever in Central Division, Fiji, 2014–2017: a case-control study. *PLoS Negl Trop Dis*. 2018;12(6):e0006571.
- [12]. Smith SI, Agomo CO, Bamidele M, Opere BO, Aboaba OO. Survey of food handlers in bukas (a type of local restaurant) in Lagos, Nigeria about typhoid fever. *Health*. 2010;2(8):951.
- [13]. Akabanda F, Hlortsi EH, Owusu-Kwarteng J. Food safety knowledge, attitudes and practices of institutional food-handlers in Ghana. *BMC Pub Heal*. 2017;17:1-9.
- [14]. Al Banna MH, Kundu S, Brazendale K, Ahinkorah BO, Disu TR, Seidu AA, et al. Knowledge and awareness about food safety, foodborne diseases, and microbial hazards: A cross-sectional study among Bangladeshi consumers of street-vended foods. *Food Cont*. 2022;134:108718.
- [15]. Asmawi UM, Norehan AA, Salikin K, Rosdi NA, Munir NA, Basri NB. An assessment of knowledge, attitudes and practices in food safety among food handlers engaged in food courts. *Curr Res Nutr Food Sci J*. 2018;6(2):346-53.
- [16]. Mallick AK, Kumar SS, Bangari J, Suyal H. Knowledge, attitude and practice of fever and febrile illness among parents of under five children. *Int J Cont Pediatr*. 2019;6(5):2103.
- [17]. Tuitoek DJ. Assessment of knowledge, attitude and practice of typhoid transmission in ishaka town council, Bushenyi District, Western Uganda. *BioClin Int Res J*. 2020;1(1), 37–41.
- [18]. Anuradha M, Dandekar RH. Knowledge, attitude and practice among food handlers on food borne diseases: a hospital based study in tertiary care hospital. *Int J Biomed Adv Res*. 2014;5(4):196-8.
- [19]. Brainard J, D'hondt R, Ali E, Van den Bergh R, De Weggheleire A, Baudot Y, et al. Typhoid fever outbreak in the Democratic Republic of Congo: Case control and ecological study. *PLoS Negl Trop Dis*. 2018;12(10):e0006795.
- [20]. Sibiya JE, Gumbo JR. Knowledge, attitude and practices (KAP) survey on water, sanitation and hygiene in selected schools in Vhembe District, Limpopo, South Africa. *Int J Envir Res Pub Heal*. 2013;10(6):2282-95.