Volume 3, Number 3, 2026
Pages 566-579
Bioscience Insights
ISSN: 3080-3489 (Print)
ISSN: 3080-3497 (Online)
BiosciInsights.com

ASSESSMENT OF AWARENESS OF PARASITIC AND BACTERIAL INFECTIONS, THEIR NEUROLOGICAL COMPLICATIONS AND THE USE OF MEDICINAL PLANTS FOR THEIR TREATMENT AMONG THE GENERAL POPULATION OF DISTRICT KOHAT

Basit Jalees[1], Shehzad Zareen[*2], Shawana Nawaz[3], Mehtab Parveen[*4], Sidra Ishaque[5], Zainab Bano[6], Qaiser Zaman[7]

*[1,*2,3,5,6]Department of Zoology, Kohat University of Science and Technology, Kohat, KP, Pakistan*
*[*4]Department of Botany, Kohat University of Science and Technology, Kohat, KP, Pakistan*
[7]Department of Zoology, Government Postgraduate College Dargai 23060, Malakand, Khyber Pakhtunkhwa, Pakistan./Kaisee Dreams Research Laboratory, Dargai 23060, Malakand, Khyber Pakhtunkhwa,

[1]basitjalees18@yahoo.com, [*2]shehzadzareen1@kust.edu.pk, [3]shawananawazkust@gmail.com, [*4]mehtabparveen57@gmail.com, [5]sidraishaq182@gmail.com, [6]zainabbano.bangash@gmail.com [7]zoologist.qaiser@gmail.com

https://doi.org/10.5281/zenodo.23466464

Article Information

Article History

Received:	June 19, 2026
Revised:	August 19, 2026
Accepted:	September 07, 2026
Available Online:	October 19, 2026

Keywords:
Parasitic infections; bacterial infections; neurological complications; seizures; epilepsy; medicinal plants; health awareness; District Kohat.

Copyright @Author
Corresponding Author: *
Shehzad Zareen, Mehtab Parveen

Abstract

Parasitic and bacterial infections remain important public-health concerns and may cause serious systemic and neurological complications. Infections involving the central nervous system can result in seizures and acquired epilepsy, while traditional medicinal practices remain an important component of healthcare in many communities. The present study assessed awareness of parasitic and bacterial infections, their neurological complications, preventive practices, treatment-seeking behavior, and knowledge and use of medicinal plants among the general population of District Kohat. A total of 300 participants were included in the study dataset supplied. Information was assessed regarding socio-demographic characteristics, awareness of parasitic and bacterial infections, transmission and preventive practices, neurological complications, medicinal-plant knowledge and use, sources of health information, and treatment preferences. A composite awareness score was generated from knowledge responses, and associations between overall awareness and socio-demographic variables were assessed using the chi-square test, with statistical significance considered at < 0.05. Basic awareness of infectious diseases was generally satisfactory. Overall, 77.3% of participants had heard of parasitic infections and 90.3% had heard of bacterial infections. Awareness of contaminated water, personal hygiene and other basic preventive practices was relatively high. However, knowledge of neurological complications was comparatively limited. Only 47.3% had heard that infections could

affect the brain or nervous system, while 54.7% recognized that certain infections could cause seizures and 42.3% recognized that some parasitic infections could affect the central nervous system. The mean awareness score was highest for transmission and prevention (7.6 ± 1.7) and lowest for neurological complications (4.2 ± 2.0). Overall, 52.3% of participants had moderate awareness, 28.7% had high awareness and 19.0% had low awareness. Overall awareness was significantly associated with age ($p = 0.045$), residence ($p = 0.014$), educational status ($p < 0.001$) and occupation ($p = 0.009$), but not gender ($p = 0.546$). Medicinal plants were widely recognized (81.3%) and 61.0% reported personal use. Garlic, ginger and mint were among the most frequently reported plants. However, 32.0% considered medicinal plants always safe and only 23.7% reported consulting healthcare professionals before combining herbal remedies with conventional medicines. The findings indicate a generally moderate level of awareness of parasitic and bacterial infections, but substantial knowledge gaps concerning neurological complications, antimicrobial resistance and safe medicinal-plant use. Targeted community health education, particularly among rural and less-educated populations, is recommended. Because the supplied dataset is identified as simulated, population-based studies are required to validate these findings in the general population of District Kohat.

INTRODUCTION

Infectious diseases caused by bacteria and parasites remain important public-health concerns, particularly in communities where environmental sanitation, access to healthcare, health literacy, and socioeconomic conditions influence disease transmission and treatment-seeking behavior. Parasitic and bacterial infections may produce a broad spectrum of clinical manifestations ranging from gastrointestinal and systemic symptoms to severe involvement of the central nervous system (CNS). CNS infections and parasitic diseases are particularly important because they may result in seizures, epilepsy, meningitis, encephalitis, brain abscesses, cognitive impairment, and other neurological disabilities. Infectious and parasitic diseases are recognized causes of acute symptomatic seizures and acquired epilepsy, with their distribution and contribution to neurological disease varying according to geographical and socioeconomic conditions (Yacubian *et al.*, 2022). Bacterial meningitis, for example, remains a significant cause of morbidity and mortality, while bacterial infections of the CNS can result in acute symptomatic seizures and subsequent epilepsy. Similarly, neurocysticercosis and other parasitic infections of the CNS are important causes of seizures in several regions of Asia and other endemic areas (Yacubian *et al.*, 2022). Despite the clinical importance of these infections, community awareness of their modes of transmission, prevention, neurological complications, and appropriate treatment may remain inadequate. Recognition of neurological manifestations is particularly important because early identification and treatment of the underlying infection can reduce severe complications. Bacterial meningitis, brain abscesses, and other CNS infections may present with fever, headache, altered mental status, seizures, focal neurological deficits, nausea, and vomiting, while delayed recognition and inadequate treatment may increase the risk of neurological sequelae (Yacubian *et al.*, 2022). Therefore, assessing public awareness is essential for identifying knowledge gaps and developing appropriate community-based health education strategies.

Alongside conventional healthcare, humans have historically depended on biological resources for food, clothing, medicines, and other necessities. Ethnobiological knowledge represents an important component of traditional healthcare systems, with communities using locally available flora and fauna for the management of various ailments (Lohani *et al.*, 2008). The continued importance of traditional and complementary medicine is also evident globally. The World Health Organization reported that approximately 170 member states had acknowledged the use of traditional, complementary, and

alternative medicine (WHO, 2019). Natural products remain an important source of biologically active compounds and continue to contribute to the discovery of therapeutic agents (Cragg & Newman, 2013). Such resources may contain diverse bioactive constituents, although their safety, efficacy, dosage, and therapeutic applicability require appropriate scientific evaluation (Alves & Rosa, 2005).

Pakistan possesses considerable biological diversity and a long-standing tradition of using medicinal plants in local healthcare practices (Ali, 1998; Khan, 2004; Mirza & Wasiq, 2007). Traditional practitioners and herbal drug markets utilize numerous plant species, particularly in rural and remote communities where access to formal healthcare may be comparatively limited. In Pakistan, ethnomedicinal investigations have documented extensive local knowledge concerning the therapeutic uses of indigenous flora (Umair *et al.*, 2019). Such practices are culturally significant; however, traditional use should not automatically be interpreted as evidence of clinical effectiveness against bacterial or parasitic infections.

The coexistence of infectious diseases, neurological complications, conventional healthcare, and traditional medicinal practices makes community awareness an important area of investigation. In particular, limited knowledge regarding infection-related neurological manifestations may delay appropriate medical consultation, while unsupervised use of medicinal plants may occur without adequate understanding of their safety, dosage, interactions, or limitations. Awareness of the causes, transmission routes, preventive measures, neurological warning signs, and evidence-based treatment of infectious diseases can therefore contribute to timely healthcare-seeking behavior.

In this context, the present study, entitled "Assessment of Awareness of Parasitic and Bacterial Infections, Their Neurological Complications, and the Use of Medicinal Plants for Their Treatment Among the General Population of District Kohat," is designed to assess the level of community awareness regarding parasitic and bacterial infections, evaluate knowledge of their potential neurological complications, and document the community's knowledge and reported use of medicinal plants. The study is expected to identify important gaps in public knowledge and provide a basis for strengthening health education, encouraging appropriate healthcare-seeking practices, and promoting informed and safe approaches to the use of traditional medicinal resources in District Kohat.

RESULTS

2.1 Socio-demographic characteristics of the study participants

A total of 300 participants from the general population of District Kohat were included in the simulated dataset. The socio-demographic characteristics assessed included age, gender, residential area, educational status, occupation, marital status, and monthly household income. These variables were considered important because demographic and socioeconomic characteristics may influence an individual's access to health information, understanding of infectious diseases, treatment-seeking behavior, and knowledge of traditional medicinal practices.

Table 2.1. Socio-demographic characteristics of the study participants (n = 300)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–25	86	28.7
	26–35	79	26.3
	36–45	61	20.3
	46–55	43	14.3
	≥56	31	10.3
Gender	Male	158	52.7
	Female	142	47.3
Residence	Urban	137	45.7
	Rural	163	54.3
Educational status	No formal education	42	14.0
	Primary	53	17.7
	Secondary	69	23.0
	Intermediate	55	18.3
	Graduate	54	18.0

	Postgraduate	27	9.0
Occupation	Student	62	20.7
	Farmer	48	16.0
	Homemaker	71	23.7
	Government employee	37	12.3
	Private employee	34	11.3
	Self-employed/business	31	10.3
	Other	17	5.7
Marital status	Married	177	59.0
	Unmarried	117	39.0
	Widowed/divorced	6	2.0
Monthly household income (PKR)	<30,000	83	27.7
	30,000–59,999	104	34.7
	60,000–89,999	65	21.7
	≥90,000	48	16.0

The simulated population consisted of 300 participants, of whom 158 (52.7%) were male and 142 (47.3%) were female. More than half of the respondents (54.3%) belonged to rural areas, while 45.7% were from urban areas. The largest age group was 18–25 years (28.7%), followed by 26–35 years (26.3%). Regarding educational status, secondary education was the most frequently reported category (23.0%), whereas 14.0% had no formal education. Homemakers constituted the largest occupational group (23.7%), followed by students (20.7%). Approximately 59.0% of participants were married. In terms of household income, 34.7% reported a monthly income between PKR 30,000 and 59,999. Overall, the sample represented a mixture of demographic and socioeconomic backgrounds, allowing assessment of variations in awareness across different population groups.

2.2 Awareness of parasitic infections

Participants were asked about their general awareness of parasitic infections, including whether they had previously heard of parasitic diseases, recognized common parasites, understood their modes of transmission, and were aware of preventive measures. The responses were categorized as *Yes*, *No*, or *Don't know*, depending on the question.

Table 2.2. Participants' awareness regarding parasitic infections (n = 300)

Awareness item	**Yes n (%)**	**No n (%)**	**Don't know n (%)**
Have you ever heard about parasitic infections?	232 (77.3)	43 (14.3)	25 (8.3)
Can parasites infect humans?	257 (85.7)	25 (8.3)	18 (6.0)
Are intestinal worms a type of parasitic infection?	241 (80.3)	31 (10.3)	28 (9.3)
Can contaminated food transmit parasites?	213 (71.0)	51 (17.0)	36 (12.0)
Can contaminated water transmit parasites?	246 (82.0)	31 (10.3)	23 (7.7)
Can poor personal hygiene increase risk?	251 (83.7)	28 (9.3)	21 (7.0)
Can inadequate sanitation contribute to transmission?	219 (73.0)	42 (14.0)	39 (13.0)
Can some parasitic infections be prevented?	244 (81.3)	27 (9.0)	29 (9.7)
Are children potentially at increased risk?	201 (67.0)	46 (15.3)	53 (17.7)
Do you know that some parasites can affect organs other than the intestine?	139 (46.3)	75 (25.0)	86 (28.7)

The findings indicate a generally moderate-to-high level of basic awareness regarding parasitic infections. A substantial majority of participants (77.3%) reported having heard about parasitic infections, while

85.7% correctly recognized that parasites can infect humans. Awareness of contaminated water as a possible transmission route was relatively high (82.0%), as was awareness of the role of poor personal hygiene (83.7%). However, knowledge concerning less commonly recognized manifestations was comparatively limited. Only 46.3% knew that some parasitic infections may affect organs outside the intestine, while 28.7% were unable to answer this question. These findings suggest that although basic awareness of parasitic infections was relatively satisfactory, knowledge of systemic and complicated infections was less developed.

2.3 Awareness of bacterial infections

Participants were also assessed regarding their knowledge of bacterial infections, their transmission, prevention, and appropriate treatment. Attention was given to antibiotic use because inappropriate antibiotic use can contribute to treatment failure and antimicrobial resistance.

Table 2.3. Awareness and knowledge regarding bacterial infections (n = 300)

Knowledge item	Correct/Yes n (%)	Incorrect/No n (%)	Don't know n (%)
Have you heard of bacterial infections?	271 (90.3)	18 (6.0)	11 (3.7)
Can bacteria cause disease in humans?	277 (92.3)	12 (4.0)	11 (3.7)
Can contaminated food transmit some bacterial infections?	243 (81.0)	32 (10.7)	25 (8.3)
Can contaminated water transmit bacterial infections?	250 (83.3)	27 (9.0)	23 (7.7)
Can poor hand hygiene contribute to bacterial infection?	263 (87.7)	21 (7.0)	16 (5.3)
Can bacterial infections be prevented through proper hygiene?	259 (86.3)	22 (7.3)	19 (6.3)
Are antibiotics used to treat some bacterial infections?	267 (89.0)	19 (6.3)	14 (4.7)
Are antibiotics effective against all infections?*	116 (38.7)	153 (51.0)	31 (10.3)
Can unnecessary antibiotic use be harmful?	229 (76.3)	39 (13.0)	32 (10.7)
Can bacteria become resistant to antibiotics?	192 (64.0)	51 (17.0)	57 (19.0)

"No" represents the scientifically correct response.

Awareness of bacterial infections was comparatively high among the simulated participants. More than 90% had heard of bacterial infections, and 92.3% recognized that bacteria can cause disease in humans. Knowledge regarding hygiene-related prevention was also high, with 87.7% identifying poor hand hygiene as a potential contributor to bacterial infection. However, an important knowledge gap was observed regarding antibiotic use. Only 64.0% were aware that bacteria can develop resistance to antibiotics, while 38.7% incorrectly believed that antibiotics are effective against all infections. This finding demonstrates a need for improved community education concerning rational antibiotic use and antimicrobial resistance.

2.4 Knowledge of modes of transmission and preventive practices

Understanding the routes through which infections are transmitted is an important component of disease prevention. Participants were therefore asked about common sources and behaviors associated with parasitic and bacterial infections.

Table 2.4. Knowledge regarding transmission routes and preventive measures (n = 300)

Statement	Correct response n (%)	Incorrect/Don't know n (%)
Drinking untreated water may increase infection risk	254 (84.7)	46 (15.3)
Eating inadequately washed vegetables may increase risk	228 (76.0)	72 (24.0)
Eating undercooked meat may transmit some infections	187 (62.3)	113 (37.7)
Washing hands before eating can reduce infection risk	271 (90.3)	29 (9.7)
Washing hands after using the toilet can reduce infection risk	278 (92.7)	22 (7.3)
Proper disposal of human waste reduces infection transmission	237 (79.0)	63 (21.0)
Safe food storage reduces bacterial contamination	231 (77.0)	69 (23.0)
Avoiding unsafe drinking water reduces infection risk	263 (87.7)	37 (12.3)
Regular cleaning of household surroundings can reduce exposure	244 (81.3)	56 (18.7)
Vaccination can prevent some bacterial infections	198 (66.0)	102 (34.0)

The majority of participants demonstrated satisfactory knowledge regarding basic preventive practices. Hand hygiene received the highest level of recognition, with 92.7% identifying handwashing after toilet use as a preventive measure and 90.3% recognizing the importance of handwashing before eating. Awareness of untreated drinking water as a risk factor was also high (84.7%). However, knowledge concerning undercooked meat was comparatively low, with only 62.3% identifying it as a potential source of infection. Similarly, one-third of participants were unaware that vaccination can prevent certain bacterial infections. These findings indicate that health education should address both common and less frequently recognized routes of infection.

2.5 Awareness of neurological complications

Neurological complications represent an important but less commonly understood consequence of certain infections. Participants were asked whether they had heard that bacterial or parasitic infections could affect the nervous system and whether they could recognize selected neurological manifestations.

Table 2.5. Awareness of neurological complications associated with infections (n = 300)

Neurological complication/knowledge item	Yes/Correct n (%)	No/Incorrect n (%)	Don't know n (%)
Have you heard that infections can affect the brain or nervous system?	142 (47.3)	91 (30.3)	67 (22.3)
Can some infections cause severe headache?	191 (63.7)	62 (20.7)	47 (15.7)
Can certain infections cause seizures?	164 (54.7)	71 (23.7)	65 (21.7)
Can some infections cause confusion or altered consciousness?	139 (46.3)	76 (25.3)	85 (28.3)
Can meningitis be associated with bacterial infection?	174 (58.0)	63 (21.0)	63 (21.0)
Can certain parasitic infections affect the central nervous system?	127 (42.3)	76 (25.3)	97 (32.3)
Do you consider persistent neurological symptoms a reason to seek medical care?	235 (78.3)	32 (10.7)	33 (11.0)

Have you ever received information about infection-related neurological complications from a health professional?	83 (27.7)	182 (60.7)	35 (11.7)

Awareness of neurological complications was substantially lower than awareness of general infection-related concepts. Less than half of participants (47.3%) had heard that infections could affect the brain or nervous system. Knowledge that parasitic infections may involve the central nervous system was particularly limited, with only 42.3% responding correctly. Awareness of seizures as a possible complication was 54.7%, while 46.3% recognized confusion or altered consciousness as a possible manifestation. Nevertheless, 78.3% of participants indicated that persistent neurological symptoms should prompt medical consultation. The relatively low proportion receiving information from healthcare professionals (27.7%) suggests an opportunity for healthcare providers to improve community education concerning serious neurological complications.

2.6 Reported history of infection and recognition of symptoms

Participants were asked whether they had previously experienced or been diagnosed with selected infectious conditions and whether they could identify common symptoms associated with infectious diseases.

Table 2.6. Reported history and recognition of infection-related symptoms among participants (n = 300)

Variable	Category	Frequency (n)	Percentage (%)
Previous history of suspected parasitic infection	Yes	92	30.7
	No	181	60.3
	Don't know	27	9.0
Previous history of diagnosed bacterial infection	Yes	137	45.7
	No	145	48.3
	Don't know	18	6.0
Recognized abdominal pain as possible symptom	Yes	232	77.3
Recognized diarrhea as possible symptom	Yes	248	82.7
Recognized fever as possible symptom	Yes	267	89.0
Recognized persistent vomiting as possible symptom	Yes	189	63.0
Recognized severe headache as potentially concerning	Yes	176	58.7
Recognized seizures as a serious neurological symptom	Yes	157	52.3
Recognized altered consciousness as a medical emergency	Yes	143	47.7

Approximately 30.7% of participants reported a previous suspected parasitic infection, whereas 45.7% reported having experienced a diagnosed bacterial infection. Fever was the most widely recognized symptom (89.0%), followed by diarrhea (82.7%) and abdominal pain (77.3%). Recognition declined for neurological symptoms. Only 52.3% identified seizures as a serious neurological manifestation, and fewer than half (47.7%) recognized altered consciousness as an emergency requiring medical attention. These results suggest that participants were more familiar with general systemic and gastrointestinal symptoms than with potentially serious neurological manifestations.

2.7 Knowledge and use of medicinal plants

The study also assessed community knowledge and reported use of medicinal plants for health-related conditions. Participants were asked whether they had knowledge of medicinal plants, whether they had personally used them, who influenced their use, and whether they regarded them as alternatives or complements to conventional healthcare.

Table 2.7. Knowledge and use of medicinal plants among participants (n = 300)

Variable	Category	Frequency (n)	Percentage (%)
Aware of medicinal plants used traditionally	Yes	244	81.3
	No	56	18.7
Have personally used medicinal plants	Yes	183	61.0
	No	117	39.0
Learned about medicinal plants from family/elders	Yes	151	50.3
Learned from friends/neighbors	Yes	76	25.3
Learned from traditional practitioners	Yes	69	23.0
Learned from media/internet	Yes	52	17.3
Believe medicinal plants are always safe	Yes	96	32.0
Believe medicinal plants can have side effects	Yes	172	57.3
Consult a healthcare professional before combining herbs with medicines	Yes	71	23.7
Use medicinal plants together with conventional treatment	Yes	94	31.3
Use medicinal plants instead of conventional treatment	Yes	47	15.7

A relatively high proportion of participants (81.3%) reported awareness of medicinal plants used traditionally, while 61.0% reported personal use. Family members and elders represented the most common source of information (50.3%), indicating the important role of intergenerational knowledge in traditional healthcare practices. More than half of participants (57.3%) recognized that medicinal plants may have side effects; however, 32.0% believed that medicinal plants are always safe. Only 23.7% reported consulting a healthcare professional before combining herbal remedies with conventional medicines. These findings highlight both the strong cultural presence of medicinal plants and the need for education regarding appropriate and safe use.

2.8 Common medicinal plants reported by participants

Participants who reported knowledge or use of medicinal plants were asked about plants commonly used in their households. The reported uses in this table represent traditional/community-reported uses and do not establish clinical effectiveness against parasitic or bacterial infections.

Table 2.8. Commonly reported medicinal plants and their traditional uses among participants

Medicinal plant	Participants reporting knowledge/use, n (%)	Commonly reported traditional use	Main preparation method
Garlic (*Allium sativum*)	119 (39.7)	General health/infection-related complaints	Raw/food
Ginger (*Zingiber officinale*)	108 (36.0)	Digestive complaints/cold symptoms	Tea/decoction
Mint (*Mentha* spp.)	96 (32.0)	Digestive complaints	Tea
Turmeric (*Curcuma longa*)	91 (30.3)	General health/inflammatory complaints	Food/drink
Neem (*Azadirachta indica*)	74 (24.7)	Skin/digestive traditional uses	Tea/other preparations
Fennel (*Foeniculum vulgare*)	68 (22.7)	Digestive complaints	Infusion
Black seed (*Nigella sativa*)	64 (21.3)	General health/traditional remedy	Oral

Coriander (*Coriandrum sativum*)	53 (17.7)	Digestive complaints	Food/infusion
Ajwain (*Trachyspermum ammi*)	49 (16.3)	Abdominal discomfort	Infusion
Aloe vera (*Aloe barbadensis*)	36 (12.0)	Skin/general traditional use	Topical/oral

Garlic was the most frequently reported medicinal plant, with 39.7% of participants indicating knowledge or use, followed by ginger (36.0%) and mint (32.0%). The reported uses were predominantly related to digestive complaints, general health, and other traditional indications rather than specifically diagnosed bacterial or parasitic infections. Family-based knowledge appeared to be particularly important in maintaining these practices. It should be emphasized that the frequencies represent reported traditional use and do not demonstrate therapeutic efficacy. Scientific evaluation would be required before any medicinal plant could be recommended as a treatment for a specific infection.

2.9 General awareness score of parasitic, bacterial and neurological infections

For analytical purposes, participants' responses to the knowledge questions were converted into a composite awareness score. Each correct response was assigned one point, whereas incorrect and "don't know" responses were assigned zero points. Participants were subsequently classified into low, moderate, or high awareness categories according to their total scores.

Table 2.9. Distribution of participants according to overall awareness level (n = 300)

Awareness domain	Mean score ± SD	Low awareness n (%)	Moderate awareness n (%)	High awareness n (%)
Parasitic infections	6.4 ± 2.1	61 (20.3)	143 (47.7)	96 (32.0)
Bacterial infections	7.1 ± 1.8	43 (14.3)	126 (42.0)	131 (43.7)
Transmission/prevention	7.6 ± 1.7	39 (13.0)	121 (40.3)	140 (46.7)
Neurological complications	4.2 ± 2.0	109 (36.3)	128 (42.7)	63 (21.0)
General awareness score	**25.3 ± 5.8**	**57 (19.0)**	**157 (52.3)**	**86 (28.7)**

The highest mean awareness score was observed for transmission and prevention (7.6 ± 1.7), followed by bacterial infections (7.1 ± 1.8). In contrast, neurological complications had the lowest mean score (4.2 ± 2.0). Overall, more than half of the participants (52.3%) demonstrated a moderate level of awareness, while 28.7% had a high level and 19.0% had a low level. The findings indicate that participants possessed relatively better knowledge about common infections and preventive practices than about neurological complications. This pattern suggests that health education programs should place particular emphasis on the recognition of serious neurological manifestations.

2.10 Association between overall awareness and socio-demographic characteristics

The relationship between overall awareness and selected socio-demographic characteristics was assessed using the chi-square test. For this simulated analysis, statistical significance was considered at $p < 0.05$.

Table 2.10. Association between overall awareness level and selected socio-demographic characteristics (n = 300)

Variable	Category	Low n (%)	Moderate n (%)	High n (%)	χ^2	p-value
Age	18–25	9 (10.5)	43 (50.0)	34 (39.5)		
	26–35	10 (12.7)	39 (49.4)	30 (38.0)		

	36–45	12 (19.7)	33 (54.1)	16 (26.2)	15.84	0.045
	46–55	12 (27.9)	25 (58.1)	6 (14.0)		
	≥56	14 (45.2)	17 (54.8)	0 (0.0)		
Gender	Male	27 (17.1)	81 (51.3)	50 (31.6)	1.21	0.546
	Female	30 (21.1)	76 (53.5)	36 (25.4)		
Residence	Urban	18 (13.1)	69 (50.4)	50 (36.5)	8.47	0.014
	Rural	39 (23.9)	88 (54.0)	36 (22.1)		
Education	No formal/Primary	31 (32.6)	50 (52.6)	14 (14.7)		
	Secondary/Intermediate	20 (16.1)	67 (54.0)	37 (29.8)	22.63	<0.001
	Graduate/Postgraduate	6 (7.4)	40 (49.4)	35 (43.2)		
Occupation	Student	7 (11.3)	29 (46.8)	26 (41.9)	9.32	0.009
	Other occupations	50 (21.0)	128 (53.8)	60 (25.2)		

The simulated analysis demonstrated statistically significant associations between overall awareness and age, residence, educational status, and occupation. Participants in younger age groups demonstrated comparatively higher proportions of high awareness than older participants. Urban residents were more likely to have high awareness (36.5%) compared with rural residents (22.1%), with the difference reaching statistical significance ($p = 0.014$). Educational status showed the strongest association with awareness ($p < 0.001$), as participants with graduate or postgraduate education had a greater proportion of high awareness. Occupation was also significantly associated with awareness ($p = 0.009$). In contrast, no statistically significant association was observed between gender and overall awareness ($p = 0.546$).

2.11 Treatment preferences and sources of health information

Participants were asked about their preferred sources of information and their approach to treating suspected infectious diseases. This section was particularly relevant to understanding whether traditional medicinal practices coexist with conventional healthcare.

Table 2.11. Sources of health information and treatment preferences among participants (n = 300)

Variable	Category	Frequency (n)	Percentage (%)
Main source of health information	Doctor/health professional	112	37.3
	Family/relatives	71	23.7
	Television/radio	38	12.7
	Internet/social media	47	15.7
	Traditional practitioner	21	7.0
	Other	11	3.7
Preferred first response to suspected infection	Visit healthcare facility	167	55.7
	Self-medication	51	17.0
	Medicinal plants/home remedies	43	14.3
	Ask family/friends	24	8.0
	Traditional practitioner	15	5.0
Would you complete prescribed antibiotic course?	Yes	218	72.7
	No	34	11.3
	Don't know	48	16.0
Would you use medicinal plants together with prescribed medicine?	Yes	94	31.3
	No	116	38.7
	Don't know	90	30.0
Would you seek professional advice before using an unfamiliar medicinal plant?	Yes	189	63.0
	No	47	15.7

	Don't know	64	21.3

Healthcare professionals were the most commonly reported source of health information (37.3%), followed by family members or relatives (23.7%). More than half of the participants (55.7%) indicated that they would visit a healthcare facility as their first response to a suspected infection. Nevertheless, 17.0% reported self-medication and 14.3% preferred medicinal plants or home remedies as their initial response. Approximately 72.7% stated that they would complete a prescribed antibiotic course, although 27.3% either would not complete it or were uncertain. Nearly one-third reported that they might combine medicinal plants with conventional medicines, emphasizing the importance of counseling regarding potential interactions and the importance of informing healthcare providers about herbal product use.

DISCUSSION

The present study assessed awareness of parasitic and bacterial infections, their neurological complications, transmission and prevention, treatment-seeking practices, and medicinal-plant use among the general population of District Kohat. Overall awareness was moderate in 52.3% of participants, high in 28.7%, and low in 19.0%. Mean scores were highest for transmission and prevention (7.6 ± 1.7) and bacterial infections (7.1 ± 1.8), whereas neurological complications had the lowest score (4.2 ± 2.0). These findings indicate comparatively better knowledge of common infections and preventive practices than of their neurological consequences.

Awareness of basic parasitic infections was relatively satisfactory. Most participants had heard of parasitic infections (77.3%), recognized that parasites can infect humans (85.7%), and identified contaminated water (82.0%) and poor personal hygiene (83.7%) as important risk factors. However, knowledge of extra-intestinal manifestations was limited; only 46.3% knew that parasites can affect organs other than the intestine, while 28.7% were unaware of this possibility. This gap is important because some parasitic infections can involve the central nervous system (CNS) and cause seizures or epilepsy. Yacubian *et al.* (2022) identified neurocysticercosis and other CNS parasitic infections as important causes of seizures in several endemic regions. Awareness of bacterial infections was somewhat higher. More than 90% of participants had heard of bacterial infections, and 92.3% knew that bacteria can cause human disease. Knowledge of hand hygiene was also high, with 87.7% recognizing poor hand hygiene as a risk factor and 86.3% identifying proper hygiene as a preventive measure. However, misconceptions regarding antibiotic use were evident. Although 89.0% knew that antibiotics are used for some bacterial infections, 38.7% incorrectly believed that antibiotics are effective against all infections, and only 64.0% recognized antibiotic resistance. Thus, awareness of antibiotics did not necessarily reflect adequate knowledge of their appropriate use.

Knowledge of transmission and prevention was generally favorable. Most participants recognized the importance of handwashing after toilet use (92.7%) and before eating (90.3%), while 84.7% identified untreated drinking water as an infection risk and 87.7% recognized the benefit of avoiding unsafe water. However, only 62.3% identified undercooked meat as a possible infection source, and 34.0% were unaware that vaccination can prevent some bacterial infections. These findings suggest that participants were more familiar with routine hygiene practices than with specific foodborne and vaccine-preventable risks. A major knowledge gap concerned neurological complications. Only 47.3% had heard that infections can affect the brain or nervous system, 54.7% recognized that certain infections can cause seizures, and 46.3% recognized confusion or altered consciousness as possible consequences. Awareness that parasitic infections can affect the CNS was even lower (42.3%). In contrast, 78.3% considered persistent neurological symptoms a reason to seek medical care. Yacubian *et al.* (2022) reported that infectious and parasitic diseases can cause acute symptomatic seizures and acquired epilepsy, while survivors of CNS infections may remain at increased risk of unprovoked seizures. Therefore, the low awareness of infection-related neurological manifestations observed in the present study represents an important health-education gap.

This issue is particularly relevant in resource-limited settings, where infectious and parasitic diseases contribute substantially to the burden of epilepsy. Yacubian *et al.* (2022) highlighted neurocysticercosis, tuberculosis, malaria, and other CNS infections as important causes of seizures in developing regions,

with sanitation, vaccination, healthcare access, and socioeconomic conditions influencing disease burden. Improving community recognition of warning signs such as seizures, severe headache, altered consciousness, and persistent neurological symptoms may therefore encourage earlier healthcare consultation. Awareness also varied significantly according to age ($p = 0.045$), residence ($p = 0.014$), educational status ($p < 0.001$), and occupation ($p = 0.009$). High awareness was greater among urban than rural participants (36.5% vs. 22.1%), while participants with graduate or postgraduate education showed higher awareness. Gender was not significantly associated with awareness ($p = 0.546$). These findings suggest that health-education interventions should particularly address rural communities and groups with fewer educational opportunities. Yacubian *et al.* (2022) similarly emphasized the contribution of socioeconomic conditions, inadequate sanitation, and limited healthcare access to infectious and parasitic disease burden. However, because the present dataset is identified as simulated, these associations should be interpreted within the study dataset and should not be generalized to the wider population of District Kohat without validation through population-based research.

The study also demonstrated substantial awareness and use of medicinal plants. Overall, 81.3% of participants were aware of traditionally used medicinal plants, while 61.0% reported personal use. Family members and elders were the main sources of information (50.3%), followed by friends or neighbors (25.3%), traditional practitioners (23.0%), and media/internet sources (17.3%). This indicates that medicinal-plant knowledge is largely transmitted through interpersonal and intergenerational pathways. Such practices are consistent with the recognized importance of traditional medicine and ethnomedicinal knowledge in many communities (WHO, 2019; Umair *et al.*, 2019). Garlic (*Allium sativum*) was the most frequently reported medicinal plant (39.7%), followed by ginger (*Zingiber officinale*) (36.0%), mint (*Mentha* spp.) (32.0%), turmeric (*Curcuma longa*) (30.3%), and neem (*Azadirachta indica*) (24.7%). Reported uses were mainly related to digestive problems, general health, inflammation, and other traditional purposes rather than specifically diagnosed bacterial or parasitic infections. However, traditional use should not be considered evidence of clinical efficacy. Although natural products contain biologically active compounds and may provide potential therapeutic leads, their efficacy, safety, dosage, and interactions require scientific evaluation (Cragg & Newman, 2013). Perceptions regarding the safety of medicinal plants also require attention. Although 57.3% recognized that medicinal plants may cause side effects, 32.0% considered them always safe, and only 23.7% consulted healthcare professionals before combining herbal remedies with conventional medicines. Since approximately one-third of participants indicated that they might combine medicinal plants with conventional medicines, community education should promote informed use, professional consultation, and disclosure of herbal-product use to healthcare providers rather than discouraging culturally established practices.

Treatment-seeking behavior reflected the coexistence of conventional and traditional approaches. Healthcare professionals were the most common source of health information (37.3%), and 55.7% reported that they would initially visit a healthcare facility for a suspected infection. However, 17.0% reported self-medication and 14.3% would initially use medicinal plants or home remedies. Although 72.7% stated that they would complete a prescribed antibiotic course, 27.3% would not or were uncertain. These findings indicate a need for education regarding timely professional assessment and appropriate infection management. Antibiotic-related misconceptions were also evident. The belief among 38.7% of participants that antibiotics are effective against all infections indicates inadequate understanding of antibiotic indications. Furthermore, the uncertainty or unwillingness of 27.3% to complete a prescribed antibiotic course highlights the need for education regarding bacterial versus non-bacterial infections, appropriate antibiotic use, treatment adherence, and antimicrobial resistance. Because the present study did not directly measure antibiotic consumption or resistance, these findings should be interpreted as indicators of educational needs rather than direct evidence of antimicrobial resistance. Finally, the neurological knowledge deficit should be considered alongside treatment-seeking and medicinal-plant practices. Yacubian *et al.* (2022) emphasized that early diagnosis and treatment of underlying infections are important in managing infection-associated seizures and that prevention of CNS infections and parasitic diseases can help reduce the burden of epilepsy. Community education should therefore emphasize the importance of timely professional assessment for seizures, altered consciousness,

severe headache, persistent neurological symptoms, and other warning signs rather than relying solely on self-medication or home remedies.

CONCLUSIONS

The present study demonstrates that the assessed population of District Kohat had generally satisfactory awareness of basic parasitic and bacterial infections, particularly their common transmission routes and preventive practices. However, knowledge of infection-associated neurological complications was considerably weaker. The lowest awareness score was observed for neurological complications, while more than half of the participants demonstrated only a moderate overall level of awareness. Significant associations of overall awareness with age, residence, educational status and occupation further indicate that health knowledge is not evenly distributed within the population. The study also demonstrates the continued importance of medicinal plants in community healthcare practices. Although medicinal plants were widely known and frequently used, misconceptions regarding their safety and limited consultation with healthcare professionals before combining herbal remedies with conventional medicines were evident. Similarly, misconceptions concerning antibiotics and antimicrobial resistance indicate a need for improved education regarding rational antimicrobial use.

RECOMMENDATIONS

Community-based health education programs should be developed to improve public understanding of parasitic and bacterial infections, particularly their less commonly recognized complications. Greater emphasis should be placed on neurological complications, including seizures, severe headache, confusion, altered consciousness, and other persistent neurological symptoms associated with infectious and parasitic diseases. Targeted awareness interventions should be provided to rural and educationally disadvantaged populations, as residence and educational status were significantly associated with overall awareness in the study dataset. Antibiotic-awareness campaigns should also be strengthened to explain that antibiotics are not effective against all infections, promote their appropriate use, and improve understanding of antimicrobial resistance. Healthcare professionals should provide appropriate counseling regarding the use of medicinal plants, particularly when patients combine herbal remedies with prescribed medicines. Traditional medicinal knowledge should be systematically documented while clearly distinguishing community-reported traditional uses from scientifically established therapeutic efficacy.

Future studies should use actual population-based samples from District Kohat to validate the patterns observed in the present simulated dataset and determine their generalizability. Further research should also examine the relationship between awareness and actual healthcare-seeking behavior rather than relying solely on stated preferences.Medicinal plants frequently reported by participants should be investigated through laboratory and clinical studies before any specific plant is recommended for the treatment of bacterial or parasitic infections. Finally, longitudinal and intervention-based studies should be conducted to determine whether structured health education can improve recognition of neurological complications, promote rational antibiotic use, and support the safe integration of traditional medicine with conventional healthcare.

REFERENCES

Alves, R. R. N., & Rosa, I. L. (2005). Why study the use of animal products in traditional medicines? *Journal of Ethnobiology and Ethnomedicine, 1*(1), 5. https://doi.org/10.1186/1746-4269-1-5

Ali, S. (1998). *Zoogeography, palaeontology and wildlife management*. Hyderabad: Nasseem Book Publisher.

Cragg, G. M., & Newman, D. J. (2013). Natural products: A continuing source of novel drug leads. *Biochimica et Biophysica Acta (BBA) - General Subjects, 1830*(6), 3670–3695. https://doi.org/10.1016/j.bbagen.2013.02.008

Khan, M. S. (2004). Annotated checklist of amphibians and reptiles of Pakistan. *Asiat. Herpetol. Res., 10*, 191–201.

Lohani, U., Rajbhandari, K., & Shakuntala, K. (2008). Need for systematic ethnozoological studies in the conservation of ancient knowledge systems of Nepal—A review. *Indian Journal of Traditional Knowledge,* 7(4), 634–637.

Mirza, Z., & Wasiq, H. (2007). *A field guide to the birds of Pakistan*. Lahore: Bookland.

Umair, M., Altaf, M., Bussmann, R. W., & Abbasi, A. M. (2019). Ethnomedicinal uses of the local flora in Chenab Riverine Area, Punjab Province, Pakistan. *Journal of Ethnobiology and Ethnomedicine, 15*(1), 7. https://doi.org/10.1186/s13002-019-0285-4

World Health Organization (WHO). (2019). *WHO global report on traditional and complementary medicine 2019*. Geneva: World Health Organization.

Yacubian, E. M. T., Kakooza-Mwesige, A., Singh, G., Carpio, A., de Figueiredo, N. V., Saute, R. L., & Marques de Haes, T. (2022). Common infectious and parasitic diseases as a cause of seizures: Geographic distribution and contribution to the burden of epilepsy. *Epileptic Disorders, 24*(6), 989–1015.

Cragg GM, Newman DJ., Natural products: A continuing source of novel drug leads. Biochimica et Biophysica Acta (BBA) - General Subjects. 2013;1830(6):3670–3695. doi:10.1016/j.bbagen.2013.02.008.

Lohani U, Rajbhandari K, Shakuntala K., Need for systematic ethnozoological studies in the conservation of ancient knowledge systems of Nepal—A review. *Indian Journal of Traditional Knowledge*. 2008;7(4):634–637.

Umair M, Altaf M, Bussmann RW, Abbasi AM., Ethnomedicinal uses of the local flora in Chenab Riverine Area, Punjab Province, Pakistan. *Journal of Ethnobiology and Ethnomedicine*. 2019;15(1):7. doi:10.1186/s13002-019-0285-4.

World Health Organization., *WHO Global Report on Traditional and Complementary Medicine 2019*. Geneva: World Health Organization; 2019.

Yacubian EMT, Kakooza-Mwesige A, Singh G, Carpio A, de Figueiredo NV, Saute RL, Marques de Haes T., Common infectious and parasitic diseases as a cause of seizures: Geographic distribution and contribution to the burden of epilepsy. *Epileptic Disorders*. 2022;24(6):994–1019. doi:10.1684/epd.2022.1491.