

Original Article

Preliminary investigation of demographic signatures of intestinal parasitic infection in rural residents of Guangxi Zhuang Autonomous Region in China

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Abstract: Background: Our present study was designed to initially unveil the epidemiological characteristics and underlying etiology of intestinal parasitic infection (IPI) in rural residents of Guangxi province in China through conducting a community-based cross-sectional survey. Material and methods: By use of an epidemiological questionnaire survey and morphologic examination, a total 700 residents from dissimilar regions around rural areas in Guangxi province were recruited for fecal samples to explore ethnic differences in IPI. The fecal specimen was collected and used for microscopic inspection of visible signs of parasitic eggs. In addition, parasitic egg samples were screened and identified to characterize the parasite-bearing IPI cases. Results: The statistical epidemiologic data exhibited that the early pathologic signs of ethnicity-sorted IPI-based rural residents occurred in a two-week period, such as headache and itchy skin. Following further one-year tracing, some potential pathological symptoms of rural locales with IPI were screened and identified, including diarrhea and anemia. Insufficient education seemed to be an underlying cause of IPI in rural residents. In addition, further morphologic signs of parasitic eggs and protozoa in IPI-based residents with pathologic symptoms were validated. Conclusions: Overall, these preliminary epidemiologic findings demonstrate that detectable pathologic signs of IPI-based rural residents in Guangxi province were associated with poor education, thus local government needs a strategy for reducing IPI and improving quality of life in locals.

Keywords: Epidemiology, intestinal parasitic infection, symptom, etiology

Introduction

Intestinal parasitic infection (IPI) refers to a parasite-causing gastrointestinal infection that may threaten human livelihood and health [1]. Etiologically, the origin of IPI is induced and developed by well-known parasites, such as *Entamoeba histolytica*, *Cyclospora cayetanensis*, *Cryptosporidium spp*, and *Giardia spp* [2]. In early clinical manifestation, the conditions of IPI may be asymptomatic through parasite-tainted food and water. In severe cases, deadly infection is transmitted through a fecal or oral pathway [3]. In statistics in recent years, 2 billion people in the world are susceptible to IPI, characterized by increased disease incidence and death rate. As revealed by pathologic examination, the clinical signs of IPI are abdominal pain, diarrhea, intestinal obstruction, and

prolapse in progressive stages [4]. In addition, the medical association between IPI and hygienic factors is found to be implicated in ethnic differences, local tradition and lifestyle [5]. The epidemiologic findings suggest that IPIs are more prevalent in Asia owing to huge population size, especially in rural areas in China [6]. More notably, the reporting of IPI is related to ethnic residents living in aggravating hygienic conditions by conducting it through social-ecological methods [7]. Regarding integrating multilevel factors, the epidemiologic data are harvested and analyzed to validate IPI and hygienic risk in different provinces in China, aiming to inhibit parasitic infection and ameliorate local human health [8]. However, as an economically underdeveloped province, the demographic sanitary situations of remote locales in Guangxi areas have not been investigated

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recently. In the current report, we planned to highlight and disclose the IPI-bearing ethnic features and healthy risk conditions in a rural population of Guangxi province in China by use of performing a community-based cross-sectional investigation.

Methods

Human design and inclusion criteria

The current study was designed by using a multi-stage, community-based cross-sectional survey in Guangxi Zhuang Autonomous Region in South central China [9]. The ethnic residents aged 3-years and above were included regardless of gender proportion, while the rural people with disabled condition, mental retardation, deaf-mute, or mental health disorders were excluded. In addition, the human sample size in each minority was designed and measured through conducting an equation of comparison with reference proportion of IPI between the Han nationality and ethnic minorities.

Human questionnaire survey

In brief, we carried out and collected the questionnaire survey from a total of 700 rural residents from Guangxi Zhuang Autonomous Region of Han, Zhuang, Yao, Miao, Dong, Mulao, Maonan, and Yi ethnic minorities in recent years. The volunteers were registered and recorded, and the raw data were collected through visiting different county, township, or village units. All rural residents were recorded to harvest relatively complete demographic information for detailed educational background and habits in different minority populations. In addition, all these locals were screened and we recorded the pathologic signs associated with IPI-infection symptoms within two-week and one-year periods.

Morphologic features of parasitic eggs in IPI cases

After data collection, subjects were recruited regardless of gender ratio, aiming for screening and identification for positive IPI cases through performing fecal inspection. Briefly, the fecal specimen was placed in a feces tube and stored in 4°C refrigerator prior to further tests. Some of fecal samples were used for microscopic examination to screen and to feature

the morphologic characteristics and signs of parasites in IPI cases. In parallel, the visible signs of parasitic eggs and protozoa in IPI-based cases were screened and photographed respectively. Accordingly, this human report was approved by the Human Research Ethics Committee of Prince of Songkla University (No. 61-257-18-1) [10, 11].

Results

Epidemiologic data and pathologic symptoms of IPI cases in Guangxi

To preliminarily present the potential IPI-causing symptoms of rural residents by investigative questionnaire method, we first visited and collected total 700 local residents in different units of ethnicities from Guangxi Zhuang Autonomous Region, named as Zhuang, Yao, Miao, Dong, Mulao, and Maonan minorities. In early detection within two-weeks of pathological signs in IPI-bearing human cases, we found some identifiable pathogenic signs induced by parasites following questionnaire investigation, such as headache, celiacgia, abdominal distension, diarrhea, itchy skin, dyspnea, pyrexia, fatigue, emesis, and hemafecia in different minority nationalities. The notably detectable ethnic minorities were Dong, Zhuang, Miao, Yao, respectively, in addition to the Han nationality (**Table 1**). Following a period of one-year of development, some further pathologic symptoms in IPI-associated cases were detected and identified in different ethnic groups respectively, especially for anemia and diarrhea. The ethnic units of Dong, Maonan, Zhuang, Yao minorities were evident in demographic proportion (**Table 2**).

Potential causes and parasite-born ovular morphology of IPI cases in Guangxi

To further reveal the underlying etiology of IPI-causing symptoms, the initial screening and identification were conducted in different ethnic populations. To begin with, demographic data showed that some of the minority-group rural residents were illiterate, while the literate population was less in current rural residents. Moreover, a majority of rural locals received insufficient high and medium levels of educational qualification, just achieving Chinese compulsory education or below (**Table 3**). In order to identify evidence of IPI cases, the fe-

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Table 1. Early pathologic features of ethnicity-assorted IPI-infected residents

Ethnicity		Dong	Zhuang	Miao	Yao	Han	Mulao	Maonan	Total	Frequency (%)
Population		100	100	100	100	100	100	100	700	
Features within two weeks	Headache	40	46	43	34	34	29	37	263	37.57
	Celialgia	21	26	26	33	16	32	25	179	25.57
	Abdominal distension	14	14	10	24	12	22	13	109	15.57
	Diarrhea	32	10	18	18	20	17	24	139	19.86
	Itchy skin	40	26	29	37	42	36	29	239	34.14
	Dyspnea	18	12	28	12	22	15	7	114	16.29
	Pyrexia	30	15	18	15	11	14	14	117	16.71
	Fatigue	26	16	27	32	30	28	23	182	26
	Emesis	21	8	7	7	4	5	14	66	9.43
Hemafecia	8	6	4	5	4	7	6	40	5.71	

Table 2. Pathologic characteristics of ethnicity-grouped IPI-infected residents

Ethnicity		Dong	Zhuang	Miao	Yao	Han	Mulao	Maonan	Total	Frequency (%)
Population		100	100	100	100	100	100	100	700	
Signs within one year	Hepatomegaly	0	2	0	1	0	1	0	4	0.57
	Splenomegaly	0	1	0	0	0	0	0	1	0.14
	Anemia	10	5	0	15	18	5	10	63	9.00
	Intestinal obstruction or prolapse	0	0	0	2	1	4	2	9	1.29
	Diarrhea	49	32	35	33	45	32	44	270	38.57
	Icterus	2	4	0	0	0	0	0	6	0.86

Table 3. Educational capacity of ethnicity-classified rural residents

Ethnicity		Dong	Zhuang	Miao	Yao	Han	Mulao	Maonan	Total	Frequency (%)
Population		100	100	100	100	100	100	100	700	
Education level	Illiteracy	23	9	11	22	22	10	14	111	15.86
	Literacy	2	4	6	9	8	7	8	44	6.29
	Primary school	45	45	41	41	41	43	49	305	43.57
	Junior middle school	23	29	29	20	19	34	20	174	24.86
	Senior high school and technical school	4	11	12	5	10	5	9	56	8.00
	Junior college	2	1	1	1	0	1	0	6	0.86
	Undergraduate education	1	1	0	2	0	0	0	4	0.57

cal samples were collected and used to screen the parasitosis before further data analysis. Further, IPI cases resulted in traceable signs of parasitic eggs from fecal specimens, including whipworm ovum, liver fluke ovum, hookworm ovum, *Enterobius vermicularis* ovum, *Ascaris* eggs, unfertilized roundworm ovum, and *Blastocystis hominis* (**Figure 1**). These visible signs of parasitic eggs were consistent with IPI-causing symptoms.

Discussion

This current epidemiological study revealed the visible morphological signs of parasite and protozoa-induced pathological symptoms in some

rural locals probably reflecting in endemic information of hygienic conditions of IPI cases in Guangxi Zhuang Autonomous Region in South central China. Intriguingly, these preliminary findings indicated that identifiable signatures of lifestyles and customs around the county, township, and village units were an effective guide for local IPI cases to improve the health environment. In addition, the underlying cause behind the parasitization warrants to be further explored.

It is well known that the local residents living with poor hygienic conditions may be inclined to develop and suffer health risks of parasitic infection before developing protozoan-inducing

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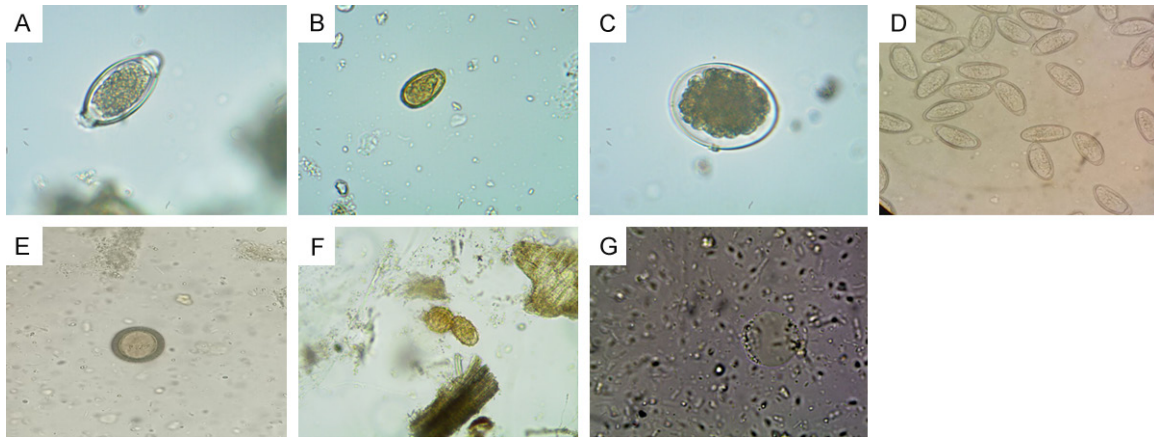


Figure 1. Morphologic pictures of parasitic eggs and protozoa in fecal samples from respective IPI cases with pathologic symptoms (scale bar =100 μ m). Note: A. Whipworm ovum; B. Liver fluke ovum; C. Hookworm ovum; D. *Enterobius vermicularis* ovum; E. *Ascaris* eggs; F. Unfertilized roundworm ovum; G. *Blastocystis hominis*.

diseases gradually in less-developed countries [12, 13]. In investigative etiology, it is believed that the individual or environmental hygienic condition was associated with IPI initiation and development [14]. In contrast, it is a few reports showing the association with comprehensive demographic, environmental, and socioeconomic factors for increasing prevalence of IPI. Based on the huge population of China, there is still a big population living in counties, townships, and villages, in which some of the backcountry districts have poor education and insufficient sanitary conditions [15, 16]. In China, there are numerous rural residents living with insufficient socioeconomic level, poor living conditions, and poor educational conditions [17]. More notably, Guangxi Zhuang Autonomous Region is an economically underdeveloped province in western China, accompanied by many rural permanent residents in remote areas [18]. As an autonomous region in China, Guangxi province consists of around 18 million people from multiple minority nationalities. In addition, most of these ethnic minorities are distributed in remote rural regions, and some of those who live in poor environmental hygiene are illiterate [19, 20]. If left unmanaged, these ethnic populations may develop asymptomatic conditions in early parasite-infecting stage before inducing the life-threatening diseases [21]. Collectively, the literature review data indicate that early detection of IPI and etiologic investigation of healthy factors may considerably improve the quality of life, and effectively enhance the life span of

rural residents in Guangxi province. In the current report, these preliminary epidemiologic data indicated the two-week and one-year investigations of pathologic signs in ethnicity-grouped IPI cases, included headache, itchy skin, diarrhea, and anemia. These potential symptoms might be responsible for health risk following parasitic exposure. Further epidemiologic investigative findings revealed that these IPI-related symptoms might result from insufficient educational capability, causing poor awareness of hygienic health. Interestingly, the morphologic signs of parasitic eggs and protozoa in IPI cases with pathologic symptoms were validated through detecting fecal samples. Taken together, these preliminary demographic data could contribute to local government in Guangxi province to lower IPI morbidity and ameliorate quality of life in rural locals.

Conclusion

Overall, these preliminary epidemiologic data elucidated the minority features of parasite-bearing rural residents of Guangxi province in China, validated by parasitic inspection. Further, these primary findings might be beneficial to educate and reduce parasitic infection, and to improve the health condition of rural locals in Guangxi Zhuang Autonomous Region.

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Disclosure of conflict of interest

None.

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