FIRST REPORT ON GASTROINTESTINAL PARASITE (GIP) INFECTION AMONG GERIATRIC COMMUNITY WITH COGNITIVE IMPAIRMENT IN SELANGOR, MALAYSIA

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ABSTRACT

Immunosenesence often changes intestinal flora and increases gastrointestinal parasite (GIP) infection susceptibility. This is potentially exacerbated by cognitive and functional decline. This study, therefore, aimed to determine the burden of GIP among older adults in institutional care. This cross-sectional study involved coprological screening and a quantitative survey among thirty-seven (n=37) residents from two nursing homes in Kajang, Selangor. Demographic data and information on the subject were collected through face-to-face interviews with caregivers and participating residents regarding their daily hygiene practice before stool sample collection. Gastrointestinal parasite (GIP) was identified by formalin-ethyl sedimentation technique and stained using Trichrome and Acid-fast. GIP was present among 34 (91.9%) of residents, 32.4% monoparasitism, 52.9% biparasitism and 14.7% polyparasitism. Up to five species were recovered, including Blastocystis spp (51.6%) and Cryptosporidium spp. (38.7%). Those of older age have increased GIP prevalence. The health impact of GIP presence in nursing homes should be a topic of future research, as well as the potential effect of infection control training among nursing home workers on GIP load in residents.

Keywords: Gastrointestinal parasite, stool sample, protozoa, helminths, geriatric community, risk factor, nursing home

INTRODUCTION

Gastrointestinal parasites (GIP) inhabit and draw nourishment from the host’s intestinal tract and contribute to the primary cause of morbidity and mortality globally, particularly in children in developing countries. An estimated 3.5 billion people are affected, and approximately 450 million individuals currently suffer from gastrointestinal parasite infections¹⁴. Much less study is known about the health consequences of GIP among older adults, with limited epidemiological studies available¹. ². ³. A previous study has reported that enteroparasite infection could impair the nutritional status of older individuals². The dwindling immune systems or immunosenesence associated with the deteriorating immune response associated with aging may lead to increased susceptibility to infections⁴. ⁵.

Institutionalized older adults tend to represent the frailest segment of society, with lower immunity function and the highest disease burden. GIP is known to infect hosts with lower immunity, poorer health status, and lack of proper hygiene practices⁶. Factors such as immobility to manage themselves and high population density may also increase the resident in this institutional setting and higher chances of GIP infections ¹⁵,¹⁶. Several studies reported that the most prevalent parasitism infections are associated with Crypto spp., Giardia spp., and Strongyloidiasis¹⁷,¹⁸. Some geriatric patients gradually have difficulty performing self-care due to physical exhaustion resulting in a deficiency in personal hygiene¹⁹. However, it is known that these infections can have adverse effects on the elderly by impairing their nutritional status through gastrointestinal-related illnesses and anemia²⁰. Therefore, this study will improve the community's health status by determining the burden of GIP among mentally impaired residents of two nursing homes and exploring the relationship between demographic factors and hygiene practice and the presence and burden of GIP.

METHODS

Study Area and Subject
A cross-sectional study was conducted among older residents from two nursing homes in...
Kajang, Malaysia, between June and November 2020. This was a volunteer-based study. About thirty-seven (n=37) mentally challenged geriatric individuals have participated in the study. Participation in this study was entirely voluntary, and informed consent was sought directly from the resident or their legal representative. Human Ethical Committee approved the study protocol of UniKL [UNIKL REC /2020/003].

**Research Instruments**

The method used in this research was an in-house survey questionnaire by interviewing orally with the caretakers for each patient and surveying the study area’s environment. All this information was used to analyse the potential risk factors for GIP infection in the elderly. The questionnaires consisted of four sections: Section A: Demographic data, Section B: Geriatric patient’s health condition, Section C: Sanitary and hygienic condition, Section D: Nursing home’s manager and Geriatric patients’ consent. Caregivers acted as surrogates for participating residents who could not provide the requested information. The questionnaire adapted from a previous study².

**Collection of Stool Samples**

Residents and caretakers were first provided with training on stool sample collection, including the appropriate amount and avoiding contamination with urine and other surfaces. Samples were mainly collected by the respective caretakers and fixed using 70% alcohol. Sterile screw-top stool containers were labeled with participants’ name code, age, date, and time of collection before passing them to the caretakers for each resident.

**Analysis and Examination**

The collected specimens were stored in refrigerator 4°C until further processing to examine for cysts, trophozoites, eggs, and oocysts. Before performing the parasitological technique, all samples were broken up and mixed thoroughly using disposable wooden sticks in the laboratory, and wet smear and formalin ethyl sedimentation techniques were carried out to determine the parasites. Next, for staining, permanent staining, including Trichrome stain and acid-fast stain, was performed, followed by observation under the microscope under oil immersion (100x). Parasite species identification and confirmation by the Malaysian Society of Parasitology and Tropical Medicine expert.

**Statistical Analysis**

Statistical analyses were performed using the Statistical Package for Social Science (SPSS) version 20 (IBM™, USA). The Pearson’s chi square test (non-parametric) was applied to determine the association between the presence of GIP with age, gender, soil contact, and personal hygiene. A p-value of less than 0.05 was considered statistically significant. The ability to estimate odds ratios were inhibited by the presence of null values in within categories, but where possible, odds ratios (OR) and 95 % confidence intervals (CI) were presented using binary logistic regression by categorizing the types of parasitism into the two categories of none to one parasite present and two or more parasites.

**RESULTS**

**Parasite identification**

Samples were collected from 37 residents from participating nursing homes, of which 34 (91.9%) samples contained at least one GIP. Monoparasitism existed in 11 (32.4%), biparasitism in 18 (52.9%) and polyparasitism in 5 (14.7%) (Figure 1). A total of five species were recovered, with Blastocystis spp. and Cryptosporidium spp as the most common (Table 1).

**Factors Associated with Gut Intestinal Parasite Infestation**

All individuals aged less than 60 years in participating nursing homes had at least one gastrointestinal parasite, and four of the five individuals (80%) with multiparasitism were aged less than sixty (p=0.057). However, when a two-by-two comparison was conducted, nursing home residents under 60 years were significantly more likely to experience parasitic infestation (p=0.014) (data not shown in table). All individuals with higher parasite infestation and multiparasitism were women. None of the individuals with a history of soil contact in their care environment had no GIP; three of the five (60.0%) with multiparasitism had soil contact.

The relationship between the physical capability to maintain personal hygiene and GIP could be considered bipolar or U-shaped. A larger percentage of individuals who were dependent or reported good ability had biparasitism or multiparasitism than those who said weak or moderate capacity in personal hygiene (Table 2). Binary logistic regression with presence of two or more parasites as dependent variable and personal hygiene as independent variable using weak or moderate personal hygiene ability as the reference category found that individuals who were dependent for personal hygiene were at 3.3 times increased odds of having two or more GIP compared to those with weak or moderate personal hygiene (OR=3.30; 95%CI 0.537 to 20.266). Those with good individual hygiene maintenance ability had 7.7 times increased odds of having two or more GIP compared to those with weak or moderate personal hygiene (OR=7.70; 95%CI 0.801 to 74.051) (Figure 3).
**Figure 1:** Profile of gastrointestinal parasites among mentally challenged geriatric community in Kajang, Selangor conducted in 2020

*As per their record (n=37) are diagnostic with mental disorder and undertaking psychiatric medication.

<table>
<thead>
<tr>
<th>Species</th>
<th>(N)</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MONOPARASITISM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blastocystis hominis</td>
<td>9</td>
<td>26.5</td>
</tr>
<tr>
<td>Cryptosporidium parvum</td>
<td>2</td>
<td>5.9</td>
</tr>
<tr>
<td><strong>BIPARASITISM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blastocystis hominis + Cryptosporidium parvum</td>
<td>18</td>
<td>52.9</td>
</tr>
<tr>
<td><strong>MULTIPARASITISM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blastocystis hominis + Cryptosporidium parvum + Enterobius vermicularis</td>
<td>1</td>
<td>2.9</td>
</tr>
<tr>
<td>Blastocystis hominis + Cryptosporidium parvum + Giardia lamblia</td>
<td>2</td>
<td>6.0</td>
</tr>
<tr>
<td>Blastocystis hominis + Cryptosporidium parvum + Entamoeba histolytica</td>
<td>1</td>
<td>2.9</td>
</tr>
<tr>
<td>Blastocystis hominis + Enterobius vermicularis + Entamoeba histolytica</td>
<td>1</td>
<td>2.9</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>34</td>
<td>100</td>
</tr>
</tbody>
</table>
Figure 2: Frequency of identified gastrointestinal according to the parasite’s species in percentage (%)

Table 2: Association analysis between possible risk factors and presence of gastrointestinal parasites among mentally challenged geriatric community.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parasites, n (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>AGE GROUP (YEARS)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;60</td>
<td>0 (0)</td>
<td>9 (81.8)</td>
</tr>
<tr>
<td>60 and over</td>
<td>3 (100)</td>
<td>2 (18.2)</td>
</tr>
<tr>
<td><strong>GENDER</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>0 (0)</td>
<td>6 (54.5)</td>
</tr>
<tr>
<td>Female</td>
<td>3 (100)</td>
<td>5 (45.5)</td>
</tr>
<tr>
<td><strong>SOIL CONTACT (for soil parasites)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3 (100)</td>
<td>8 (72.7)</td>
</tr>
<tr>
<td>Yes</td>
<td>0 (0)</td>
<td>3 (27.3)</td>
</tr>
<tr>
<td><strong>PERSONAL HYGIENE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dependent</td>
<td>1 (33.3)</td>
<td>1 (9.1)</td>
</tr>
<tr>
<td>Weak</td>
<td>1 (33.3)</td>
<td>1 (9.1)</td>
</tr>
<tr>
<td>Moderate</td>
<td>0 (0)</td>
<td>9 (81.8)</td>
</tr>
<tr>
<td>Good</td>
<td>1 (33.3)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

*Pearson's Chi-Square Test
N: Number examined, P-value: Asymp. Significance, 2 sided*
DISCUSSION

This study represents the first report to investigate the presence of GIP among the mentally challenged geriatric community in Malaysia. Despite the low sample numbers, the study population's infection rate was very high (91.9%). Worldwide studies among the elderly have recorded a prevalence of intestinal infection ranging from 10.8% to 30.5% in Brazil\(^2\) and (29.5%) in Iran\(^6\). This study's high prevalence of infections was possibly related to immunological deficiencies that occur with aging and impaired ability to self-care.

Overall, protozoan infections were dominant (96.7%, \(n=60\)) in the study cohort, while the least common was helminthic infection 3.2% (\(n=2\)). This finding concorded with the previous results from Brazil (80.8%; 19.2%) and Nepal (68.8%; 31.3%) \(^2\)-\(^7\). In Nepal, infections among the elderly are rated equally between protozoan and helminthic infection\(^4\). Protozoan infection is common among the geriatric community due to the precarious conditions of sanitation and hygiene standards present in poor elderly communities\(^2\).

The most common gastrointestinal parasite detected was *Blastocystis hominis*. The previous study from Southern Iran and Kashan, Iran, showed similar findings from the mentally challenged geriatric community \(^8\), \(^9\). In both subjected homes, it was noted that water sources were not fitted with either manual or automatic water filters, instead consumed after boiling the water before drinking. Another possibility of causing the high protozoan infection rate could be inadequate boiling water. Consumption of contaminated water or food and poor hygiene practices were significant risk factors for *Blastocystis* infection among the elderly in developing countries \(^10\). Therefore, the unavailability of filtered water in both nursing homes may be the leading cause of *Blastocystis* spp. transmission. Another showed that *Blastocystis* infections were associated with several factors, including close contact with animals, inadequate sanitation, and agricultural activities \(^11\).

*Cryptosporidium* spp. was also recovered in more than a third of the patients in this study. This finding was parallel to a study in Iran and Brazil conducted among the old folks with inadequate hygiene and high population density \(^12\). According to a previous study in Nepal, the age group above 60 was reported at higher risk of *Cryptosporidium* spp. infection\(^7\) due to weak health and easy transmission via fecal-oral route \(^13\). In the present study, the living condition of the nursing homes could have facilitated the *Cryptosporidium* transmission due to the crowded living spaces, shared food and water sources and shared toilet facilities.

This study detected *Giardia lamblia* and *Entamoeba histolytica* were the least common protozoan parasites (3.2%). This result was supported by the previous study among the elderly in Nepal (1.5%), indicating the risk of infection with *Giardia lamblia* declined among the aging population. This is due to the humoral and cellular immune responses (IgA and IgM) as a reaction to infection with *Giardia spp*. in the clearance of intestinal infection \(^4\). Meanwhile, the *Entamoeba histolytica* findings were contrary to reports in Nepal and Brazil, where this infection was most common among the elderly \(^2,4\).
as this infection could easily be transmitted due to their direct oral-fecal transmission\textsuperscript{12}.

Finally, the only helminth recovered in this study was \textit{Enterobius vermicularis} (n=2). In Iran, \textit{E. vermicularis} infection was high in geriatric and mentally challenged patients primarily because of lack of personal hygiene and sanitation to difficulty performing self-care \textsuperscript{9}. While in Brazil, \textit{Schistosoma mansoni} (n=5) was recovered among the geriatric community\textsuperscript{9}. Based on their knowledge with regards to their hygiene practices, it was possible that close contact among the patients in addition to gardening or yard cleaning could have facilitated the risk of exposure to this parasite. Thus, close contact between residents living in nursing home in this study could have facilitated \textit{E. vermicularis} infections \textsuperscript{13}.

Our findings were consistent with results from Santos et al., (2017), Engroff et al., (2016), and Saeidinia et al., (2016), where there was no significant association between the presence of gastrointestinal parasites in the elderly and intrinsic factors such as; age group (\(p=0.057\)), contact with soil (\(p=0.346\)), gender (\(p=0.998\)) and ability to self-care (\(p=0.101\)). However, we assume non-compliance to good hygiene among the disability/mentally challenged geriatric patients and consumption of unfiltered water plays an essential role in the parasite in this study\textsuperscript{8}.

\section*{Study limitation}

The study has a limited sample size due to the medical and mental condition of the subject. The risk factor associated with these infections is age groups which could be influenced by the low number of participants in the study. Therefore, future study needs to widen the sample size and investigate possible risk factors that trigger gastrointestinal parasite infection among the mentally challenged geriatric community, allowing the magnitude of the problem to be identified.

\section*{CONCLUSION}

This study reports the first of high prevalence of asymptomatic gastrointestinal parasite infections among the mentally challenged geriatric community in nursing homes. Most of the infected individuals were detected as \textit{Blastocystis} spp. and \textit{Cryptosporidium} spp. which could be acquired via water-borne or food-borne. This study highlights proper care and treatment for the infected individuals, as well as the implementation of good hygiene programs and safe drinking water in the community.

\section*{Conflict of Interest}

There is no conflict of interest in this study.

\section*{Funding}

This study was supported by the Malaysian Society for Parasitology & Tropical Medicine (MSPTM) community grant fund 2018.

\section*{REFERENCES}


