PREVALENCE AND RISK FACTORS FOR INTESTINAL PROTOZOA INFECTION IN ELDERLY RESIDENTS AT LONG TERM RESIDENCY INSTITUTIONS IN SOUTHEASTERN BRAZIL

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SUMMARY

This study determined the prevalence of intestinal protozoa in Long Term Residency Institutions for the Elderly (ILPI) in elders, nurses and food handlers, identifying the risk factors associated with the infections. Stool samples taken from the elderly (n = 293), nurses (63) and food handlers (19) were studied. Questionnaires were used with questions related to sociodemographic variables, health, behavior and health characteristics. Stool samples were examined using the techniques of Faust and Ziehl Neelsen, and the prevalence of *G. duodenalis, Cryptosporidium* spp.*, E. histolytica/dispar* in the elderly was 4.0%, 1.0% and 0.3% respectively. Nurses and food handlers showed 4.8% and 5.2% positivity only for *G. duodenalis*, respectively. The origin of the individuals and contact with domestic animals has been associated with infection by *G. duodenalis* in the elderly, and contact with domestic animals was considered a risk factor for infection. The last stool examinations were related to *Cryptosporidium* spp.. None of the variables were associated with *E. histolytica/dispar*. The frequency of hand washing was significantly associated with *G. duodenalis* among nurses. The frequency of positive samples of *G. duodenalis*, *Cryptosporidium* spp., *E. histolytica/dispar* showed that ILPIs environments are conducive to this occurring due to contact between the elderly, nurses and food handlers, which are often poorly trained in hygiene procedures and food handling.

KEYWORDS: Elderly; Intestinal protozoa; Risk factors.

INTRODUCTION

Enteric parasitosis in the elderly can acquire a serious nature due to the ageing of the immune system leading to morphophysiological changes in these individuals[8,28].

The intestinal protozoa *G. duodenalis*, *Cryptosporidium* spp. and *E.histolytica/dispar* are important for the elderly because they are borne in water and food and are associated with unreliable hygiene habits. *G. duodenalis* and *Cryptosporidium* spp. are also important in public health due to their zoonotic potential[25]. The prevalence of these protozoa is related to human clusters, therefore, nursing homes became important sites for the research of these organisms[6].

Despite the ageing of the world's population and the presence of these protozoa in several localities, there are few reports on their prevalence and epidemiological aspects in the elderly population. Therefore studies are needed to improve the quality of life of this section of the human population. This study determined the prevalence of intestinal protozoa in elderly residents and workers at Long Term Residency Institutions for the Elderly (ILPI), investigating the risk factors for infection in these individuals.

MATERIAL AND METHODS

This study was characterized as sectional and was conducted between December 2009 and October 2010 in the 16 ILPI in the municipalities of Araguari, Monte Alegre de Minas, Tupaciguara and Uberlândia, in the State of Minas Gerais, Brazil.

The population studied composed of 293 elderly residents in those ILPIs of both genders, with an age range of between 60 and 106 years old. 63 nurses and 19 food handlers from the same institutions were also evaluated.

Stool samples were collected and stored in identified collector flasks. These flasks were transported to the Parasitology Laboratory of the Federal University of Uberlândia (UFU), stored under refrigeration at 4 °C and processed within 24 hours of the collection time. Due to the intermittent pattern of *G. duodenalis* and to increase the reliability of the results, three stool samples were collected from each individual on alternate days[5].

Each sample was divided in two, and the first portion was used in

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the search for *G. duodenalis* and *E.histolytica/dispar* cysts using 33% of Zinc Sulfate Centrifugal Flotation in the Method[10], performed with fresh feces. In the second portion the three samplings were pooled together and preserved in 10% formalin, they were used in the search for *Cryptosporidium* spp. oocysts by examining the concentration in formalin ether[22] and Ziehl Neelsen staining[13]. Three slides were made per individual and examined by two trained professionals.

Four questionnaires were prepared, one related to the ILPI; another for the elderly; the third for the nurses and the fourth for the food handlers.

The data were analyzed by EPI INFO 3.3.2 software (CDC, Atlanta, GA, USA). The Chi-square test (X^2, $\alpha = 5\%$) was used in the comparison of two proportions. The ANOVA test was used for the comparison between the groups and the variables in which the average of the results were used. The Mann-Whitney test was used when the data did not present a normal distribution. The o*dds ratio* (OR) with a confidence interval (CI) of 95%[16] was used to evaluate the possible risk factors associated with infection of the intestinal protozoa. At frequencies lower than five, the statistical significance was calculated using simulation by the Monte Carlo method with 2,000 samplings being studied[29].

The study was approved by the Ethical Research Committee - CEP, under the CEP/UFU: 031/10 Protocol.

RESULTS

Out of the total number of samples taken from the elderly, 28 (9.5%) tested positive for intestinal protozoa, distributed as 10 (35.7%) for *G. duodenalis*, three (10.7%) for *Cryptosporidium* spp., nine (32.2%) for *Entamoeba coli* and two (7.1%) for *Endolimax nana*. Four of the elders (14.3%) presented bi-parasitism, with two (50.0%) being positive for *G. duodenalis* and *E. coli*; one (25.0%) for *E. nana* and *E.coli* and one (25.0%) for *E.histolytica/dispar* and *E. coli.*

Regarding the positivity of *G. duodenalis* (n = 12) among the sociodemographic, hygienic and behavioral variables (Table 1), the origin (OR = 1.70 (0.30-7.75); p = 0.03) and contact with domestic animals, all were statistically significant with exception of the last which was considered a risk factor for infection (OR = 15.34 (1.66-114.32); p = 0.02). The other variables related to health care had no relationship with this protozoon.

Table 1

Sociodemographic, hygienic and behavioral profile of 293 elderly, positive and negative for *Giardia duodenalis* and residents in 16 ILPI from the municipalities of Araguari, Monte Alegre de Minas, Tupaciguara and Uberlândia surveyed from December 2009 to October 2010

	Infected		Non Infected		OR (IC 95%)a	p-value b
	Number	%	Number	%		
Origin						
Araguari	7	2.3	46	15.8		
Monte Alegre de Minas	1	0.3	17	5.9	1.70 (0.30-7.75)	0.03*
Tupaciguara	2	0.7	12	4.0		
Uberlândia	2	0.7	206	70.3		
Gender						
Male	6	2.0	124	42.4	1.26 (0.37-4.24)	0.45
Female	6	2.0	157	53.6		
Hand washing before and after meals and after bathroom use						
Yes	12	4.0	203	69.3	Undefined	0.74
No	0	0	78	26.7		
Hand washing with water and soap						
Yes	10	3.3	205	70.0	1.35 (0.43-3.30)	0.29
No	2	0.7	76	26.0		
Contact with domestic animals						
Yes	2	0.7	5	1.8	15.34 (1.66-114.32)	0.02*
No	10	3.3	276	94.2		
Abdominal pain						
Yes	2	0.7	22	7.5	1.98 (0.28-8.79)	0.32
No	10	3.3	259	88.5		
Weight loss						
Yes	0	0	26	8.9	Undefined	0.26
No	12	4.0	255	87.1		

a = OR *Odds* Ratio; IC, Confidence Interval; b = Fisher Exact Test, Chi-square Test, ANOVA, Chi-square Test with Monte Carlo simulation or logistic regression * $p \leq 0.05$.

Table 2

Sociodemographic, hygienic and behavioral profile of 293 elderly, positive and negative for *Cryptosporidium* spp. and residents in 16 ILPI from the municipalities of Araguari, Monte Alegre de Minas, Tupaciguara and Uberlândia surveyed from December 2009 to October 2010

Variables	Infected		Non Infected		OR (IC 95%) [a]	p-value [b]
	Number	%	Number	%		
Origin						
Araguari	0	0	53	18.1		
Monte Alegre de Minas	0	0	17	5.8	Undefined	0.75
Tupaciguara	0	0	12	4.1		
Uberlândia	3	1.0	208	71.0		
Gender						
Male	2	0.7	128	43.7	2.52 (0.19-75.09)	0.41
Female	1	0.3	162	55.3		
Hand washing before and after meals and after bathroom use						
Yes	3	1.0	171	58.4	Undefined	0.99
No	0	0	119	40.6		
Hand washing with water and soap						
Yes	2	0.7	276	94.2	3.35 (0.22-88.03)	0.18
No	1	0.3	14	4.8		
Contact with domestic animals						
Yes	1	0.3	3	1.0	23.14 (0.69-349.6)	0.07
No	2	0.7	287	98.0		
Feces examination						
Yes	3	1.0	268	91.5	Undefined	0.76
No	0	0	22	7.5		
Time of feces examination						
More than one year	1	0.4	240	88.5		
Between six months and one year	2	0.7	8	3.0	Undefined	0.04*
Less than six months	0	0	12	4.4		
Unknown	0	0	8	3.0		
Abdominal pain						
Yes	1	0.3	22	7.5	4.65 (0.15-63.1)	0.76
No	2	0.7	268	91.5		
Weight loss						
Yes	1	0.3	26	8.9	4.26 (0.14-57.72)	0.28
No	2	0.7	264	90.1		

a = OR *Odds* Ratio; IC, Confidence Interval; b = Fisher Exact Test, Chi-square Test, ANOVA, Chi-square Test with Monte Carlo simulation or logistic regression * $p \leq 0.05$.

Three elders (1.0%) presented single parasitism with *Cryptosporidium* spp.. Among the analyzed variables, only the time of completion of the last coproparasitological examination was statistically significant ($p = 0.04$) (Table 2).

Only one elderly presented positivity for *E.histolytica/dispar,* however without symptoms. The analyzed variables were not significant ($p > 0.05$).

Three nurses (4.8%) were tested positive for *G. duodenalis* and sociodemographic, behavior and associated factors with elderly health care, were not significant ($p > 0.05$). The frequency of hand washing during the day, about 36.66 ± 5.77 times ($p = 0.02$), was the only variable

related to hygiene that presented statistical significance with undefined o*dds* r*atio* (OR) (Table 3).

One (5.2%) out of the 19 food handlers presented parasitism for *G. duodenalis*. No statistically significant difference among the analyzed variables was observed ($p > 0.05$).

DISCUSSION

The prevalence of *G. duodenalis* in the elderly was higher than observed in previous studies[1,2,3,20,23] and lower than observed in other studies[12,14,27]. The difference in the results can be associated with the number of samples taken, methodology, environmental differences and

Table 3
Sociodemographic, hygienic and behavioral profile associated with the elderly care of the 63 nurses, positive and negative for *Giardia duodenalis* and working in 16 ILPI from the municipalities of Araguari, Monte Alegre de Minas, Tupaciguara and Uberlândia surveyed from December 2009 to October 2010

Variables	Infected		Non Infected		OR (IC 95%) [a]	p-value [b]
	N°	%	N°	%		
Origin						
Araguari	0	0	4	6.3		
Monte Alegre de Minas	0	0	3	4.8	Undefined	0.91
Tupaciguara	0	0	2	3.2		
Uberlândia	3	4.8	51	80.9		
Gender						
Male	1	1.6	5	7.9	5.24 (0.15-79.95)	0.26
Female	2	3.2	55	87.3		
Frequency of daily hand washing						
Up to ten times	0	0	10	15.9		
Between 10 and 20 times	0	0	28	44.4	Undefined	0.02*
Between 21 and 30 times	1	1.6	18	28.6		
More than 31 times	2	3.2	4	6.3		
Hand washing before and after meals and after bathroom use						
Yes	3	4.8	57	90.4	Undefined	0.21
No	0	0	3	4.8		
Hand washing before and after caring for the elderly						
Yes	3	4.8	59	93.6	Undefined	0.95
No	0	0	1	1.6		
Contact with domestic animals						
Yes	2	3.2	29	46.0	2.11 (0.15-64.96)	0.48
No	1	1.6	31	49.2		
Abdominal pain						
Yes	1	1.6	14	22.2	1.62 (0.05-22.78)	0.56
No	2	3.2	46	73.0		
Weight loss						
Yes	1	1.6	14	22.2	5.24 (0.15-79.95)	0.26
No	2	3.2	46	73.0		

a = OR *Odds* Ratio; IC, Confidence Interval; b = Fisher Exact Test, Chi-square Test, ANOVA, Chi-square Test with Monte Carlo simulation or logistic regression * $p \leq 0.05$.

host immunological conditions. Researchers claim that there is a lower risk of *G. duodenalis* infection with the advancement of age due to cellular and humoral immune responses that would protect these individuals from re-infection[15,19].

The prevalence observed for *Cryptosporidium* spp. in the elderly was lower than the ones presented on research[7,21,24]. Factors affecting the survival and the number of oocysts present in the environment, such as rain or agricultural practices, can interfere with differences in the prevalence of that protozoan. The prevalence of intestinal protozoa is associated with the combination of multiple variables that determine the interaction between the parasite, the host and the environment[18]. In addition, the migration of people and the presence of animals as reservoirs, linked to poor sanitary conditions, are factors that contribute to contamination through drinking water which is the main route of transmission of this protozoan[24].

The prevalence of *E.histolytica/dispar* was lower than the previous ones mentioned[2,3,23,24]. This protozoan is common in inhabitants of developing countries, affecting predominantly people living with precarious socioeconomic conditions, inadequate hygiene practices and malnutrition[24]. The prevalence of this parasite is influenced by local agglomeration, inadequate supply of water, quality of consumed water, lack of basic sanitation, bathroom habits, lack of adequate urban services, age, ingestion of raw vegetables, number of bedrooms and bathrooms per house and the presence of other intestinal protozoa[4].

In this study, as well as in others[14,23], gender and age were not important variables; however, some authors mention gender as a factor associated to giardiasis[27]. Age did not present any correlation with the presence of *Cryptosporidium* spp., but is an important factor[7,21]. The elderly are more susceptible to having serious illnesses with age advancement, and these diseases can present longer duration thereby

increasing the chance that individuals may have higher rates of secondary infections, such as enteroparasitosis[9]

The origin of the institution where the elderly lived was important only when associated with *G. duodenalis,* and there is no basis of explanation for this association. Nevertheless, the water quality and the level of basic sanitation in the municipality are highlighted as having the potential to influence the quality of life and health of the local population.

Good personal hygiene habits are fundamental for reducing the transmissibility of pathogens. Poor hygiene behavior, contaminated hands, food and water can spread pathogens[11].

Contact with domestic animals increased the risk of the elderly acquiring *G. duodenalis* by 15.34 times. The transmission of this protozoan can occur from person to person through food, the environment (mainly by direct contact with contaminated soil and water) or contact with animals. The understanding of *Giardia* transmission from dogs and other animals to humans and vice versa depends on more biological, molecular and epidemiological studies[17].

The time of the last coproparasitological examination proved to be an important variable in the presence of *Cryptosporidium* spp. infection. For some authors, despite the clinical examination being the first step in the diagnosis of protozoa infection, the parasitological examination is essential for establishing the presence of the parasite in the individual[3].

The 4.8% prevalence of infection rate was observed among the nurses who cared for the elderly in this study. As they are the professionals responsible for the hygiene and medication of the institutionalized elderly, they can be a source of infection for those elders. Direct person-to-person transmission occurs mainly in closed communities, such as children's day care centers, orphanages and nurseries[26].

The association between the frequency of hand washing and the positivity of *G. duodenalis* in the health professionals was observed in this study. It is expected that higher frequency in hand washing decreases the likelihood of the presence of pathogens. However, factors such as water quality and the procedure used in hand washing can be critical in determining the presence of intestinal protozoan cysts and thus, leading to the contamination of these professionals.

The presence of *G. duodenalis* among the food handlers is important because one positive individual can be the source of contamination to others. The food handlers are responsible for ensuring that the food remains healthy throughout its preparation process[16]. Approximately 10 to 20% of food-borne disease outbreaks are resultant from contamination by food handlers[30].

The positivity for *G. duodenalis*, *Cryptosporidium* spp. and *E.histolytica/dispar* demonstrate that ILPI are supportive environments to the occurrence of these infections due to contact between the elderly, nurses/nursing, technicians/caregivers and food handlers.

CONFLICT OF INTEREST

Not declared.

RESUMO

Prevalência e fatores de risco para infecção por protozoários intestinais em idosos residentes nas Instituições de Longa Permanência no Sudeste do Brasil

Este estudo determinou a prevalência de protozoários intestinais em Instituições de Longa Permanência para Idosos (ILPI), enfermeiros, manipuladores de alimentos identificando fatores de risco associados às infecções. Amostras de fezes de idosos (n = 293), enfermeiros (63), manipuladores de alimentos (19) foram estudadas. Foram aplicados questionários relacionados a variáveis sociodemográficas, de higiene, comportamento e características de saúde. As amostras de fezes foram examinadas pelas técnicas de Faust e Ziehl Neelsen e a prevalência de *G. duodenalis, Cryptosporidium* spp*., E.histolytica/dispar* nos idosos foi de 4,0%, 1,0% e 0,3%, respectivamente. Enfermeiros e manipuladores de alimentos apresentaram 4,8% e 5,2% de positividade apenas para *G. duodenalis*, respectivamente. A origem dos indivíduos, o contato com animais domésticos foram associados à infecção por *G. duodenalis* nos idosos, sendo que o contato com animais domésticos foi considerado um fator de risco para a infecção, o tempo do último exame coproparasitológico foi relacionado a *Cryptosporidium* spp.. Nenhuma das variáveis apresentaram associação com *E. histolytica/dispar*. A frequência da lavagem das mãos foi associada significativamente com *G. duodenalis* entre enfermeiros. As frequências de amostras positivas para *G. duodenalis, Cryptosporidium* spp., *E. histolytica/dispar* demonstram que ILPIs são ambientes propícios para esta ocorrência devido ao contato entre idosos, enfermeiros, manipuladores de alimentos, que muitas vezes são mal treinados em procedimentos de higiene e manipulação de alimentos.

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