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Prevalence of intestinal parasites and associated risk factors in Rwanda

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Abstract: **Intestinal parasites are endemic in most developing nations, including Rwanda, this is possibly caused by poor sanitation and low personal hygiene. The primary purpose of this current research was to assess the prevalence of intestinal parasite and associated risk factors in three selected health centers from Ruli district hospital. In this cross-sectional study, we used direct smear to assess parasitic infections from 380 samples; we also used structured questionnaires to collect data used to determine risk factors. We then analysed the data by SPSS version 16, Chi-square test and Cramer's V. The general prevalence of IPIs found in this study was 51.8%. *Entamoeba Histolytica* was detected in 22.4% of the positive patients. Factors like not using both pipe, boiled and using stagnant water; of not cleaning kitchen materials with pipe water and detergent, not always cleaning the kitchen and not washing fresh fruits before eating; not washing hands with pipe water and soap, not washing hands after toilet, not cutting fingernails after growing and swimming in freshwater, lakes, stream and toilet utilization were measurably correlated with the prevalence rate recorded in this research (P<0.05).Based on these results, we finally conclude that IPIs were one of the significant issues in the study areas. Thus, the local health sector should collaborate with community health programs for providing health education to increase the knowledge, attitude, and practice about parasitic intestinal infections, their transmission mechanisms, and prevention and control methods.**

Keywords: **Prevalence, Intestinal parasitic infections, Risk factors, Rwanda.**

1. BACKGROUND

Parasites are organisms belonging to one or two major taxonomic groups called Protozoa and Helminths (worms). Such kind diseases have standard features, and they are prevalent in communities of low socioeconomic status and poor hygiene, preferring larval skin penetration, and oral-fecal transmission [1]. Parasitic infections have been with humans since the past decades. Also, today, such diseases continue to be among the leading causes of human suffering and death throughout the world, statistically, parasitic infections are reported to affect more than 1billion worldwide [2]. Parasitic infections have an immense influence on the lives of humans producing a great variety of illnesses, the effects of these illnesses could be fatal, severe, chronic, incidental, or even asymptomatic (Besufikad Belachew, 2017). Intestinal helminths impact over one-sixth of the world's population with particularly high-risk such as pregnant women and children [4] and many studies have suggested that protozoan and helminthic parasites are significant causative agents of gastrointestinal disorders including diarrhea, dysentery, vomiting, loss of appetite, hematuria, abdominal distension, other physical and mental health problems in endemic countries [5]. Strong recurrent *Ascaris lumbricoides* and *hookworm* illnesses can trigger malnutrition, anemia in high-risk groups, and grow retardation in children [6]. Intestinal parasitic diseases have been shown to keep challenging health care professionals and medical services globally, and they are considered being among the major diseases of public health problems in sub-Saharan Africa [7]. For example, one study conducted in Ethiopia reported that IPIs rates were high among the schoolchildren [8] and many health centers reported that most of the people who go to health centers in Rwanda have at least one intestinal parasitic infection [9]. Therefore,

this study aimed to assess the prevalence and risk factors of intestinal parasites among Rushashi, Muyongwe, and Coko health centers. The results will help to improve the knowledge available and urge policymakers to establish practical solutions to fight against parasitic intestinal infections not only in the study area but to the whole society.

2. MATERIALS AND METHODS

2.1. Description of the Study Area

The research was conducted in Northern Province, Gakenke District, especially Ruli hospital in it is three selected health centers Rushashi HC, Coko HC, and Muyongwe HC. The study area is 42 Km away from the center of Kigali City.

2.2. Study Population

All individuals residing at the chosen study sites are assumed to be the sample group for this study. According to NISR (2012), the total population living in the three selected study areas was 55662. Of these, 17806 people who live are from the Rushashi sector, 18516 are from the Ruli sector, while people from Coko represent 16340.

2.3. Sample Size Determination and Sampling Technique

The study sample was determined with time. From August to October 2016, a total of 380 suspected patients attended three health centers; this number of patients was considered as the sample frame.

2.4. Collection of stool samples

Each individual was given a pre-labeled stool container and to collect the samples. The stool samples were carried to the parasitological laboratory, and this was done in every health center's parasitological laboratory for parasitological examination.

2.5. Questionnaire Survey

The content of the questionnaire included full identification of the patient and risk factors that may contribute to the prevalence of intestinal parasites (water utilization and source, food hygiene, body hygiene, toilet utilization, and animals in the family). The questionnaire was initially developed in English and then translated into the local language (Kinyarwanda). The structured questionnaires were administered to 380 respondents at their respective health centers. The questionnaire administration was conducted during the collection of stool samples from the study subjects. For children who are not able to answer the questions on the questionnaire, their parents or caretakers took the responsibility of filling the surveys.

The questionnaire comprising two subparts:

- The first subpart dealt with information regarding patient identification elements such as age, sex, education level, Profession, marital status, and habitat.
- The second subpart stated the information related to awareness of risk factors on intestinal parasites.

Inclusion Criteria

All suspected patients attending Rushashi, Coko and Muyongwe health centers during

the study period is included in this study.

Exclusion Criteria

All patients refusing to answer the questionnaire were excluded from this study.

2.6. Laboratory parasitological examination procedures

All collected stool samples were characterized macroscopically based on their consistency (formed, loose or watery), presence and absence of larval stages of parasites and other macroscopic features seen by the researcher. Slides were

prepared directly by wet mounting in saline and iodine solutions and observed via direct light microscopy. Intestinal parasitic infections results were recorded, and risk factors assessed at this stage.

2.7. Data Analysis

All data got from parasitological labs and data from questionnaires were chronologically put in Microsoft Excel sheets. Advanced software nominated Statistical Package for the Social Sciences (SPSS) was used to analyze data. Descriptive statistics, Chi-square analysis, and Cramer's V tests were calculated to determine intestinal parasites prevalence, the association of risk factors and strength of associations with the prevalence, respectively. The 95% CI was used to show the accuracy of data analysis. Probabilities less than 5% ($P < 0.05$) were considered statistically significant.

3. RESULTS

3.1. General Characteristics of the study participants

This study was targeting 380 individuals attending three selected health centers in which males represented 40.5%, while females represented 59.5%. Besides, 47.1% of the target population were single, and 43.7% of them were married, whereas the divorced and widowed population represented 2.9%, 6.3% respectively of the total of the targeted population. Basing on professional status in the society of study area, 33.4% of the target population was unemployed, 28.7% were farmers, civil servant and private sector workers represented by 24.7% and 13.2% respectively. Besides, in the study area, the habitat had been classified into three categories: commercial center, agglomeration, and rural these three categories presented 18.4%, 41.6%, and 40% of the total of the target population, respectively. Of all individuals involved in the study, 24.7% of them had no education level. In contrast, people who had attended primary school, secondary, and university represented 39.5%, 23.4%, and 12.4% of the total target population, respectively, the above-mentioned results are all presented in Table 1.

3.2. Intestinal parasites prevalence across health centers

Muyongwe health center had a high IPIs rate compared to other health centers. The overall prevalence of IPIS across the three considered health centers was 51.80% (Table 2). As it is presented in table 3 Among identified intestinal parasites, the most prevalent intestinal parasites were *Entamoeba histolytica* which was observed in 85 (22.4%) of the positive patients followed by *T. intestinalis* observed in 43(11.3%), *Giardia Lambria were* observed in 26 patients (6.8%), 22 (5.8%) and 21 (5.5%) of the infected patients were infected by *Ascaris lumbricoides* and *Entamoeba Coli*, respectively. The group of young kids, which range between one year and five years old, recorded the highest prevalence of 70.0% compared to other age groups percentages (table 4). However, of the 380 patients we got during this study,154 of them were male and 67(43.5%) had of at least one intestinal parasitic infection and females in this study were 226; among them, 130(57.9%) had intestinal parasitic infections (table 4). Basing on results presented in (table 5), there was remarkably high infections rates in farmers (72.5%), followed by unemployed (55%). In contrast, the civil servants and private presented the decreased parasitic infection,41.5% ,16%, respectively. It was also noted that rural residents recorded the highest prevalence of infection, followed by commercial center residents and those from agglomeration recorded the least prevalence of infection. On the other hand, primary school pupils recorded the highest prevalence of intestinal parasites, followed by those who have no education level, their respective infection rates percentages were 66.7% and 59.6%. Furthermore, secondary students and university graduates recorded the lowest infections rate of 25.8% and 38.3 %, respectively.

3.3. Association of intestinal infections prevalence with risk factors

Seeking to see the cross-talk between the prevalence and water utilization, we performed analysis using Chi-square and Cramer's V test, and the results showed that the prevalence of intestinal parasites infections among patients who did not use pipe; boiled water , and those who used stagnant water had a significant association ($P < 0.05$) with intestinal infections, prevalence recorded in this study. Basing on the results given by used Cramer's V test during data analysis, our results revealed that both using stagnant and not using pipe water had a great relationship with the prevalence of the parasitic infection recorded in this study **(Table 6).** We checked whether the food hygiene is linked with the parasitic infection prevalence found in this study and the outcome of our analysis which is presented **(table 7)** showed that the fact of not cleaning kitchen materials with pipe water and detergent and not washing fresh fruits before eating had a

statistically significant association (P < 0.05) with the prevalence of parasitic intestinal infections and all of three factors recorded a strong relationship (Cramer's V=0.571, 0.553,respectively) with intestinal parasites recorded in this manuscript. Trying to confirm if body hygiene is really correlated with the parasitic infections found in this study, we used Chi-square and Cramer's V test to assess both association and strength of the association. The outcome of the analysis showed that facts such as not washing hands with pipe water and detergent; not washing hands after toilet; not cutting fingernails after growing and swimming in fresh water; lakes and stream) showed a statistically significant and strong association with the prevalence of intestinal parasites infections (P < 0.05) **(table 8).**On the other hand, using Chi-square and Cramer's V test, we assessed the relationship between the parasitic infections and toilet utilization, and we finally noted that toilet utilization had a significant association with the prevalence of intestinal parasites infections all its three components had (*P* < 0.05). Types of the toilet and using own and covered toilet worrisomely strong association while to clean always, the toilet had a moderate association with the intestinal parasites' infections (Cramer's V=0.556, 0.498, respectively) **(table 9).**

4. DISCUSSION

Our prevalence findings of 51.8 % were greater juxtaposed to the results of a study from Turkey (22.4%) [10], Saudi Arabia (10.94%) [11]. On the other hand, it was comparatively low in studies performed in Ethiopia (62.3%), Thailand (68.1%), Nepal (71.2%) [12], this high prevalence may occur because of poor personal hygiene, lack of modern latrines and the usage of unsafe water. In addition, our results showed that among the positive patients, *Entamoeba histolytica* was the most dominant intestinal parasite and was present in 85 (22.4%) patients' stools which was high compared to the rate recorded in a study from Ethiopia [13], Hawassa University students' clinic, Southern Ethiopia (18%) [14], however, the rate of *Entamoeba histolytica* recorded in this study was low compared to infection rate recorded in a study from Rwanda (54.5) [15].

In the current study, we also observed the high prevalence of intestinal parasites in [1-5 [years old group 70.0% and this result was remarkably high compared to the results of a study from Nigeria (65.9%) [16] and Ghana (15%) [17] the high rate infection is may be linked to the less awareness of personal hygiene measure and low level of knowledge about mode of transmission of intestinal parasites.

Our results showed that females had a higher prevalence of intestinal infections (57.9%) than males, which had recorded 42.1%. This rate noted in females was low compared to the results reported in a study from Tanzania, that recorded 58.1% for females and 41.9% for males [18]. In contrast , a study from Saudi Arabia reported low rates of intestinal infection 0.58% for females and 0.38% for males [19].

In this current study, we noted a high infection rate in the group of unemployed; farmers and civil servants ,our results were in agreement with those from Saudi Arabia [11], and a study from Ethiopia [20] reported near similar to our results of 70% for unemployed,50.2% for farmers and civil servant recorded 37.5% of parasitic intestinal infections, and this is probably linked to poor personal, low education on the main ways that intestinal parasites contaminate human as it is reported in a study from the USA [21].

However, we found that people who do not have access to clean water were supposed to use stagnant water, and both two factors showed a significant (P-value <0.05) relationship with the prevalence rate recorded in this current study, these results were in agreement with results a study performed from Yemen [22]. We also noted that the fact of not cleaning kitchen materials with pipe water and detergent; not washing fresh fruits before eating were significantly associated with the infections rates recorded in this study, these results are in agreement with a study from Burkina Faso [23]. In addition, factors such as not washing hands with clean water and detergent, not washing hands after toilet with clean water and soap, not cutting fingernails after growing and swimming in freshwater, lakes, stream were found to be significantly associated with the high rate of parasitic infections found in this current study such kind of results were also reported in a study from Ethiopia [24]. We also found that the facts such as types of toilet, not using own and covered toilet; and that the toilet is not always cleaned showed a significant relationship with the prevalence recorded in this study, the same findings were reported from different countries such as Ethiopia [25], Rwanda [26]. Some scientists concluded that in developing nations, where there is inadequate hygiene, untreated water and poor healthcare, such parasite diseases have created socio-economic devastation and disrupted healthcare in rural vulnerable populations.

5. CONCLUSION

This current study has tried to point out relatively the prevalence of parasitic intestinal infections and associated risk factors among patients attending three health centers Rushashi, Muyongwe, and Coko health centers of Ruli hospital in Gakenke District. In the current study intestinal parasitic infections had been identified, and it had shown a high prevalence of intestinal protozoan infections with *Entamoeba Histolytica* and *Trichomonas Intestinalis* being the most predominant protozoa among patients attended health centers in the study period. Several poor hygiene-related risk factors were found to be statistically associated with parasitic intestinal infections. However, there is a need for community mobilization towards provision and use of safe and adequate water supply, latrine construction to reduce open field defecation. The high overall prevalence of intestinal parasitic infections in the present study the need mass deworming in the community and establishment of good personal hygiene and environmental sanitation; public health education is also necessary on the transmission of intestinal parasite infection in communities, participatory approaches and combined efforts from the community and health sectors are needed to control the study areas.

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Abbreviations

IPIs: Intestinal Parasitic Infections

HC: Health Center

NISR: National Institute of Statistics Rwanda

Conflicts of interest

The authors do not have any conflict of interest.

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APPENDICES - A

Tables and Legends

Table 1: General demographic characteristics of the Study Participants.

	Total tested patients	Percentage
Gender		
Male	154	40.50%
Female	226	59.50%
Marital status		
Single	179	47.10%
Married	166	43.70%
Divorced	11	2.90%
Widowed	24	6.30%
Widowed	24	6.30%
Profession		
Unemployed	127	33.40%
Farmer	109	28.70%
civil servant	94	24.70%
Private	50	13.20%
Habitant		
Commercial center	70	18.40%
Agglomeration	158	41.60%
Rural	152	40.00%
Education level		
Analphabet	94	24.70%
Primary school	150	39.50%
Secondary School	89	23.40%
University	47	12.40%

Table 2: General prevalence of intestinal parasitic infections.

HC	Number of tested patients	Number of positive cases	% of GI infections +ve
Rushashi	96	59	15.5%
Coko	108	46	12.1%
Muyongwe	176	92	24.2%
Total	380	197	**51.80%**

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Table 3: Prevalence of identified intestinal parasites

	Total infections in all health centers N=197	Prevalence %
Entamoeba histolytica	85	22.4
Trichomonas intestinalis	43	11.3
Giardia	26	6.8
Ascaris lumbricoides	22	5.8
Entamoeba coli	21	5.5

Table 4: Distribution of intestinal parasite infections by age and sex

		Results		
Ages group	**Tested patients**	**Negative**	**Positive**	**Percentage**
[1-5[	20	6	14	70.00%
[5-15[	84	38	46	54.80%
[25-35[	67	32	35	52.20%
[15-25[	98	50	48	49.00%
[35-45[	43	25	18	41.90%
[45-above [	68	32	36	52.90%
Sex				
Male	154	87	67	43.50%
Female	226	96	130	57.50%
Total	380	183	197	

Table 5: Intestinal parasites infections according to profession, habitat, and education level.

			Results		
	Tested Patients	**Percentage**	**Negative cases**	**Positive cases**	**Prevalence %**
Profession					
Farmers	109	33.40%	30	79	72.5
unemployed	127	28.70%	56	71	55.9
civil servants	94	24.70%	55	39	41.5
Private	50	13.20%	42	8	16.0
Habitat					
Commercial center	70	18.40%	33	37	52.9
Agglomeration	158	41.60%	73	79	50.0
Rural	152	40.00%	77	81	53.3
Education level					
Illiterate	94	24.70%	38	56	59.6
Primary school	150	39.50%	50	100	66.7
Secondary School	89	23.40%	66	23	25.8
University	47	12.40%	29	18	38.3

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Table 6: Association of intestinal infections prevalence with water utilization and source

Risk factor	Status	Tested patients (%)	Positive (%)	Negative (%)	Chi-square Value	DF	Significance Level (p-value)	Strength of Association – Cramer's V
Water utilization and source								
Pipe water	**Yes**	196 (51.6)	39(19.8)	157(80.2)	1.654	1	0.0001	0.66
	No	184(48.4)	158(85.8)	26(14.2)				
Boiled water	**Yes**	71(18.7)	28(39.4)	43(60.6)	5.382	1	0.02	0.119
	No	309(81.30)	169(54.6)	140(45.4)				
stagnant water	**Yes**	224(58.90)	169(75.4)	55(24.6)	1.218	1	0.0001	0.566
	No	156(41.1)	28(17.9)	128(82.1)				
mineral water	**Yes**	4(1.1)	2(50)	2(50)	0.005	1	0.941	0.004
	No	376(98.9)	196(52.1)	181(47.9)				

Table 7: Association of intestinal infections prevalence with food hygiene

Risk factor	Status	Tested patients (%)	Positive (%)	Negative (%)	X^2	DF	(p-value)	Strength of Association – Cramer's V
Food hygiene								
washing fresh food before cooking	yes	82(21.6)	38(46.3)	44(53.7)	1.267	1	0.26	0.058
	No	298(78.4)	159(53.3)	139(46.7)				
cleaning kitchen materials with pipe water and detergent	yes	219(57.6)	60(27.4)	159(72.6)	1.237	1	0.001	0.571
	no	161(42.4)	137(85.1)	24(14.9)				
washing fresh fruits before eating	Yes	225(59.2)	65(28.8)	160(71.2)	1.164	1	0.001	0.553
	No	155(40.8)	132(85.2)	23(14.8)				

Table 8: Association of intestinal parasitic infections prevalence with body hygiene

Risk factor	status	Tested patients (%)	Positive (%)	Negative (%)	X2	DF	p-value	Strength of Association – Cramer's V
Body hygiene								
washing hands with clean water and detergent	Yes	178(46.8)	46(25.8)	132(74.2)	9.663	1	0.001	0.488
	No	202(53.2)	151(74.75)	51(25.25)				
washing hands after toilet with clean water and detergent	Yes	196(51.6)	39(19.9)	157(80.1)	1.654	1	0.001	0.66
	No	181(48.4)	158(85.9)	26(14.1)				
cutting finger nails after growing	Yes	220(57.9)	62(28.2)	158(71.8)	1.172	1	0.001	0.555
	No	160(42.1)	135(84.4)	25(15.6)				
Swimming in fresh water, lakes, stream…	Yes	159(41.8)	144(90.6)	15(9.4)	13642	1	0.001	0.657
	No	221(58.2)	53(23.9)	168(76.1)				

Table 9: Association intestinal parasites infections prevalence with toilet utilization

Risk factor	Status	Tested patients (%)	Positive (%)	Negative (%)	X2	DF	(p-value)	Strength of Association – Cramer's V
Toilet utilization								
Types of toilet	**Open**	224(58.9)	169(75.4)	55(24.6)	1.218	1	0.001	0.556
	Modern	156(41.1)	28(17.9)	128(82.1)				
using own and covered toilet	**Yes**	242(63.6)	80(33.1)	162(66.9)	94.18	1	0.001	0.498
	No	138(36.4)	117(84.7)	21(15.3)				
Toilet is always cleaned	**Yes**	135(35.5)	45(33.3)	90(66.7)	14.825	1	0.001	0.275
	No	245(64.5)	156(63.67)	89(36.33)				