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A Study on Intestinal Parasites that Cause Diarrhea and Some of Physiological Effects on Children in Baghdad

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Abstract

In developing nations, such as Iraq, diarrhea is the main cause of sickness and mortalities in children under the age of five, Diarrhea is the augmentation of water content in stools because of an imbalance in the normal functioning of physiologic processes of the small and large intestine responsible for the absorption of various ions, other substrates, and consequently water. The most common cause of diarrhea is eating foods that upset the digestive system ,allergies and intolerances to certain foods (Celiac disease), malabsorption of food (poor absorption). Numerous infections, such as viruses, bacterium, and parasites, are responsible for its development. The purpose of this study was to identify the frequency of intestinal parasite (IP) infections, kinds and its physiological effects on children under the age of five who had diarrheal diseases.

Methods: A cross-sectional research study was carried out in Baghdad, Iraq (al mahmoudia and other Hospitals), between September 2021 and January 2023. The analysis comprised youngsters under the age of nine who attended healthcare facilities during the observation period and had diarrhea. A standardized questionnaire was used to collect demographic information and risk factors for intestinal parasite infections (IPIs). As per usual practices, single, fresh stool samples were used to check for IPs utilizing the direct wet mount investigation and Ziehl-Neelsen staining of formyl-ether concentrated specimens. SPSS software for Statistics version 20 was used to analyze the data.

Results: 150 kids in all—32.67% boys and 67.3 girls participated in the investigation. In total, there were 41/150 IPs, or 27.3% of the population. In six youngsters (4%) there were two species of IPs found. Giardia lamblia was the parasite that was discovered the most frequently (8%), followed by Enterobius vermicularis (6.7%). After adjusting for other factors, the multivariable findings suggest that \geq age 24 months was a factor in IPIs (AOR=0.332, 95%CI: 0.094-0.465). **Conclusion:** This research discovered that children with diarrheal illnesses frequently had intestinal parasites. The Giardia lamblia genotype was the one that was found most commonly. Parents of young children ought to get health advice on how to avoid diarrheal infections generally and IPIs particularly.

دراسة عن الطفيليات المعوية التي تسبب الاسهال وبعض التأثيرات الفسيولوجية على الاطفال في بغداد

هبة حازم صالح

الخلاصة

في الدول النامية ، مثل العراق ، يعتبر الإسهال السبب الرئيسي للمرض والوفيات لدى الأطفال دون سن الخامسة ، والإسهال هو زيادة محتوى الماء في البراز بسبب خلل في الأداء الطبيعي للعمليات الفسيولوجية الصغيرة والكبيرة. الأمعاء المسؤولة عن امتصاص الأيونات المختلفة ، والركائز الأخرى ، وبالتالي الماء. السبب الأكثر شيوعاً للإسهال هو تناول الأطعمة التي تزعج الجهاز الهضمي ، والحساسية وعدم تحمل بعض الأطعمة (مرض الاضطرابات الهضمية) ، وسوء امتصاص الطعام (سوء الامتصاص). عدوى عديدة ، مثل الفيروسات والبكتيريا والطفيليات ، مسؤولة عن تطورها. الهدف من هذه الدراسة هو التعرف على وتيرة الإصابة بالطفيليات المعوية وأنواعها وتأثيراتها الفسيولوجية على الأطفال دون سن الخامسة المصابين بأمراض الإسهال. تم إجراء دراسة بحثية مقطعية في بغداد ، العراق (المحمودية ومستشفيات أخرى) ، بين سبتمبر ٢٠٢١ ويناير ٢٠٢٣. اشتمل التحليل على صغار السن الذين تقل أعمارهم عن تسعة أعوام والذين حضروا مرافق الرعاية الصحية خلال فترة المراقبة وكانوا يعانون من الإسهال. تم استخدام استبيان موحد لجمع المعلومات الديموغرافية وعوامل الخطر لعدوى الطفيليات المعوية (IPIs). وفقاً للممارسات المعتادة ، تم استخدام عينات براز مفردة طازجة للتحقق من وجود IPIs باستخدام فحص التركيب الرطب المباشر وتلطيف Ziehl-Neelsen للعينات المركزة من فورميل إيثر. تم استخدام برنامج SPSS للإحصاء الإصدار ٢٠ لتحليل البيانات.

النتائج: ١٥٠ طفلاً ٣٢.٦٧٪ فتیان و ٦٧.٣ فتیات شاركوا في التحقيق. في المجموع ، كان هناك ١٥٠/٤١ IPIs ، أو ٢٧.٣٪ من السكان. في ستة شباب (٤٪) تم العثور على نوعين من IPIs. كانت الجيارديا لامبليا هي الطفيل الأكثر تكراراً (٨٪) ، تليها 6.7٪ Enterobius vermicularis). بعد ضبط العوامل الأخرى ، تشير النتائج متعددة المتغيرات إلى أن عمر ٢٤ شهراً كان عاملاً في (AOR = 0.332 ، IPIs (95% CI: 0.094-0.465). الخلاصة: اكتشف هذا البحث أن الأطفال المصابين بأمراض الإسهال كثيراً ما يكون لديهم طفيليات معوية. كان النمط الجيني Giardia lamblia هو الأكثر شيوعاً. يجب على أولياء أمور الأطفال الصغار الحصول على المشورة الصحية حول كيفية تجنب التهابات الإسهال بشكل عام والمعالجة المباشرة للأمراض بشكل خاص.

Introduction:

Diarrhea can cause dehydration (when your body loses large amounts of water), electrolyte imbalance (loss of sodium, potassium and magnesium that play a key role in vital bodily functions). An estimated 1.7 billion instances of diarrheal illness are reported annually worldwide [1]. For kids, diarrhea can be especially harmful and is still one of the primary reasons for death and morbidity in kids under the age of five [2]. An average 760,000 children die from diarrhea each year, making it the leading cause of mortality in children under the age of five [3].

Having loose or watery stools at minimum three times a day, or more regularly than is typical for an individual, is considered to be experiencing diarrhea, in accordance with the World Health Organization (WHO) [4, 5]. It is a typical sign of gastrointestinal illnesses brought on by a variety of pathogens, such as viruses, bacterium, and parasites [6]. In impoverished nations, intestinal parasites (IPs) and bacterial infections more frequently cause diarrhea than viruses do [7].

Children in impoverished nations are most frequently infected with intestinal parasite infections (IPIs) [8]. The most frequent protozoan parasites that lead to severe diarrhea in children are *Giardia duodenalis* (*G. duodenalis*), *Cryptosporidium parvum* (*C. parvum*), and *Entamoeba histolytica* (*E. histolytica*) [9]. Diarrhea, along with stomach discomfort, vomiting, flatulence, and losing weight, is the primary clinical symptoms of IP diseases. Younger children in addition to individuals who are malnourished and immune-compromised may experience severe effects [10, 11]. In developing

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nations, such as Iraq, intestinal helminthic infections are also a significant burden in addition to protozoan parasites. Children in schools and daycare centers around the nation frequently contract intestinal schistosomiasis and soil-transmitted helminthes (STHs) [12]. *Salmonellas*, *Shigellas*, and *Campylobacters* are bacterial diseases, as are *IPs E. G. histolyticas*. In underdeveloped nations, diarrhoea is frequently brought on by *duodenalis*. *Isosporas (Cystoisosporas)* *bellis* and *Cyclosporas cayetanensis*, two *Cryptosporidium* species, frequently cause diarrhea in immune-compromised individuals. Emerging helminthic parasites are another issue, some of which can sometimes be spread through water from animals' reservoirs hosts [13]. Several parasites have significant host specificity and just one host is needed to complete the life cycle [14]. The mechanisms of diarrheal illness spreading are largely recognized, and because of this, they could be eliminated by education and the use of the right tools and technologies, even when the reasons of infections are not always recognized or quantifiable [15]. Consequently, the purpose of this study was to ascertain the prevalence of IP infections in children under the age of five who had diarrheal illnesses.

Methods:

Study setting and duration: This research was performed in Baghdad at Hospital between September 2021 and January, 2023.

Study participants :

Inclusion criteria: 150 child between the ages of four and 108 months who presented to the survey's medical centers with diarrhea (a minimum of three watery or loose bowel motions each day), Those whose guardians or

parents gave their authorization to participate in the research were also included. No child who attended to the healthcare facility with diarrhea throughout the trial duration was omitted since they all met the inclusion criteria.

Exclusion criteria: Kids who were receiving antiparasitic medication and whose guardians did not give their permission to take part in this study were to be excluded. Furthermore, none of the kids were receiving antiparasitic medication before being diagnosed, and all of the parents/guardians who refused to give their permission to participate in the study were excluded.

Data collection: The clinical and demographic statistics were given by the parents or legal guardians of the youngsters. Every enrolling child's stool sample was taken and tested for IPs in combination with the questionnaire.

Singular, fresh stool samples were taken from survey respondents and placed in clean, labelled stool cups for the following tests: First, fresh stool samples were directly wet mounted and inspected under a microscope at 100x and 400x magnifications to look for vegetal as well as other types of IPs. A tiny quantity of faeces was combined with a drop of physiological saline using an applicator stick for the direct wet mounting process. The sample was then wrapped with a cover slip and viewed underneath a microscopy. Secondly, 1,000x magnifying examinations of formol-ether condensed samples stained with the refined Ziehl-Neelsen technique were performed to look for Isospora, Cyclospora, protozoan and oocysts of Cryptosporidium. Following standard protocol for the refined Ziehl-Neelsen staining technique, formol-ether oocyst concentrations, and direct wet mounting inspection [16]. The

samples were analyzed and handled by a skilled lab technician. Additional blinded technician double-checked all of the negative samples and 10% of the positive slides.

Data analysis:

A computer was used to insert, filter, and analyze the data using the SPSS Statistics 20 software program. To characterize the social demographic details of the research respondents, descriptive statistical analysis have been used. The risk variables for IPs in the children involved were evaluated using bivariate and multivariate analysis. P-values was considered significant if <0.05 .

Ethical considerations:

The consent form was self-signed by parents or guardians who could read and write. After being delivered the written consent and information page. Children who tested positive for IPs received treatment at the hospitals in accordance with national regulations.

Results:

Socio-demographic characteristics:

The general characteristics of the participants in the study are displayed in Table 1. The study involved 150 kids, ages four months to nine years, who visited a medical facility with diarrhea. 71.3 percent of the kids were younger than 24 months old. 101 of the kids were girls, or 67.3%. The distribution of ages and gender amongst the study respondents is shown in Figure 1. The vast majority of kids (92%) lived in urban areas, with the other 8% living in nearby rural areas. The majority of children's families (86%) comprised five or fewer individuals.

Intestinal parasite incidence:

Forty one (27.3%) of the total number of study participants' children tested positive for at least one IP species. 3.8% of the youngsters tested had two infections. The most frequent parasite found was *Giardia lamblia* (8%), which was followed by *Enterobius*

vermicularis (6.7%). Additionally, 4.7% of kids tested positive for the Children in each group tested positive for Trichuris trichiura and Entamoeba histolytica at a rate of (2.7%). Two percent of participants had Ascaris

Hymenolepis nana species. lumbricoides, and one child had Taenia saginata. Figure 2 displays the incidence rates of the IPs identified in this investigation.

Table 1: General characteristics of the studied patients:

Variables	Parameters	N (%)	p-value
Age	<2 years	107 (71.3)	0.001*
	2-5 years	35 (23.3)	
	>5 years	8 (5.33)	
Sex	Male	49 (32.67)	0.024*
	Female	101 (67.3)	
Residence	Rural	12 (8)	0.015*
	Urban	138 (92)	
Family members	<5	129 (86)	0.019*
	≥5	21 (14)	

*p-value significant if <0.05.

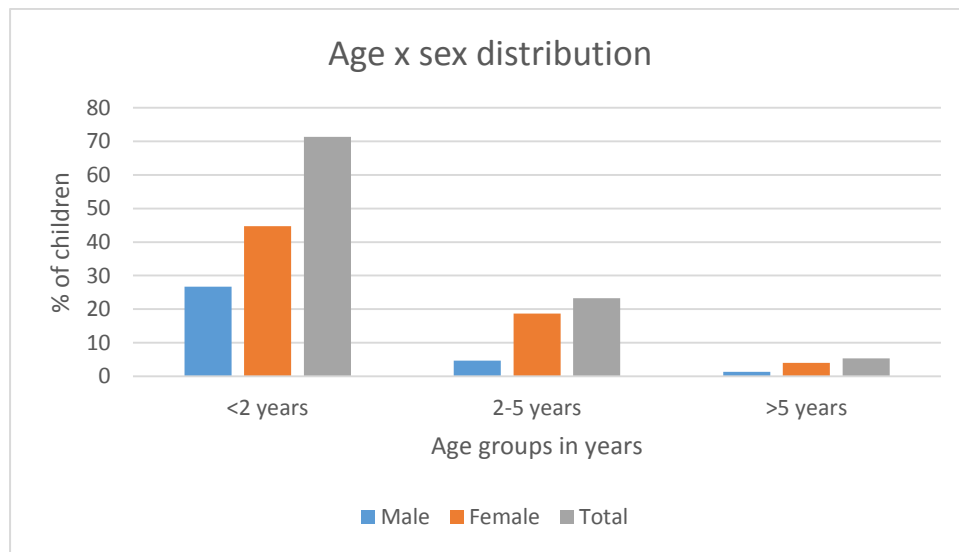


Figure (1): Sex and age distribution of the survey respondents

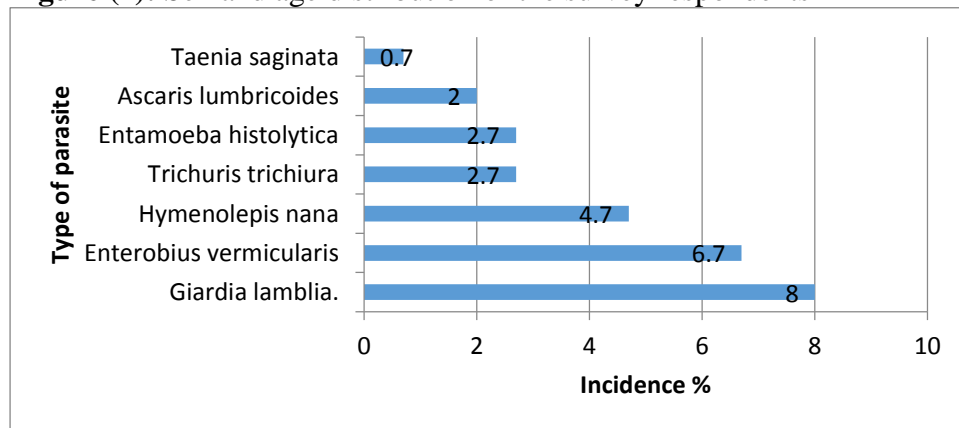


Figure (2): frequency of intestinal parasites found in children under 9 with diarrhea who tested positive

More than half of the kids (63.3%), based on the details provided by the guardians or parents, experienced watery diarrhea. Most of the youngsters (79.1%) experienced diarrhea for 1 to 5 days. Almost (32.9%) of participants vomited.

Table 2 lists the frequency of each of the isolated IPs, divided by age group. In children under the age of two, Giardia lamblia and Enterobius vermicularis were found in 9 (6%) and 6 (4%) cases, respectively. One

youngster between the ages of 2 and 5 has the Taenia saginata species.

Clinical and physiological Intestine parasite infections-related variables:

Table 3 lists the factors associated to IPs in the research respondents. The research included a nearly equal number of boys (32.67%) and girls (67.3%), with IP incidence rates of 7.3 and 20%, respectively. There was no discernible gender difference in the prevalence of IPs (p = 0.152).

Table (2) : Lists the frequency of each of the isolated IPs

	<2 years	2-5 years	>5 years	Total
Giardia lamblia.	9 (6)	2 (1.3)	1 (0.7)	12 (8)
Enterobius vermicularis	6 (4)	2 (1.3)	2 (1.3)	10 (6.7)
Hymenolepis nana	4 (2.7)	2 (1.3)	1 (0.7)	7 (4.7)
Trichuris trichiura	2 (1.3)	2 (1.3)	-	4 (2.7)
Entamoeba histolytica	3 (2)	1 (0.7)	-	4 (2.7)
Ascaris lumbricoides	3 (2)	-	-	3 (2)
Taenia saginata	-	1 (0.7)	-	1 (0.7)
Total	27 (18)	10 (6.7)	4 (2.7)	41 (27.3)

Table (3): Univariate and multivariable assessments of variables related with parasite infections among children under the age of five who have diarrheal disorders

Variable	Parameters	Intestinal parasites		COR (95%CI)	AOR (95%CI)
		Positive n (%)	Negative n (%)		
Gender	Male	11 (7.3)	38 (25.3)	1.172 (0.413–2.265)	0.671 (0.344–1.233)*
	Female	30 (20)	71 (47.3)	1	1
Age	<2 years	27 (18)	80 (53.3)	1	1
	2-5 years	10 (6.7)	25 (16.7)	0.294 (0.096–0.487)*	0.332 (0.094–0.465)*
	>5 years	4 (2.7)	4 (2.7)		
Residency	Rural	9 (6)	3 (2)	0.543 (0.125–0.458)*	0.548 (0.087–0.659)*
	Urban	32 (21.3)	106 (70.7)	1	1
Family members	<5	30 (20)	99 (66)	1	1
	≥5	11 (7.3)	10 (6.7)	0.742 (0.379–1.728)	0.684 (0.146–2.782)*
Breastfeeding	Yes	41 (27.3)	88 (58.7)	1	1
	No	0	21 (14)	0.454 (0.235–0.932)*	0.669 (0.251–2.483)*
Breastfeeding pattern	Breastfeeding with complementary food	15 (10)	21 (14)	1.281 (0.629–2.756)	1.259 (0.77–3.477)

	EBF	26 (17.3)	67 (44.7)	1	1
Complementary food initiated	Before 6th month	15 (10)	21 (14)	0.799 (0.382–2.478)	0.889 (0.345–2.452)
	After 6th month	26 (17.3)	88 (58.7)	1	1
Contacting with animals	Yes	10 (6.7)	51 14 (9.3)	1.458 (0.258–4.945)	0.455 (0.525–2.521)*
	No	31 (20.7)	95 (63.3)	1	1
Cow drug contact	Yes	2 (1.3)	3 (2)	1.364 (0.458–4.859)	0.694 (0.254–2.985)*
	No	39 (26)	106 (70.7)	1	1
Proper food storage	Yes	6 (4)	15 (10)	1.235 (0.145–4.456)	0.852 (0.963–2.456)*
	No	35 (23.3)	94 (62.7)	1	1
Disposing waste in compound	Yes	6 (4)	37 (24.7)	1.123 (0.951–4.753)	0.258 (0.423–2.954)*
	No	35 (23.3)	72 (48)	1	1
Hand washing after toilet	Yes	4 (2.7)	40 (26.7)	1.645 (0.462–4.658)	0.248 (0.548–2.984)*
	No	37 (24.7)	69 (46)	1	1
Water Source	Tape water	29 (19.3)	76 (50.7)	1	1
	Mineral water	12 (8)	33 (22)	1.548 (0.751–4.468)	0.852 (0.158–2.845)*
HIV Status	Positive	0	6 (4)	1.515 (0.546–4.984)	0.728 (0.253–2.098)*
	Negative	41 (27.3)	103 (68.7)	1	1

The incidence of IP was 17.3% in infant who were exclusively breastfed (EBF), and 10% in infants who were breastfed but also received complementary nutrition. There was no discernible difference. As per IP individuals, complementary nutrition started earlier to six months constituted 10% of the examined children, while complementary meals started after six months formed 17.3%. Animals interactions and cows medication use made up, respectively, 6.7 and 1.3% of all interactions.

The incidence of IPs was 27 (18), 10 (6.7), and 4 (2.7), respectively, amongst children aged < 24 months (71.3%), 2–5 years (23.3), and >5 years (5.33). As per age demographic, there was a significant difference in the incidence of IPs (COR=0.294, 95%CI: 0.096-0.487). The multivariable results suggests that the age ≥24 months was a determinant of IPIs

(AOR=0.332, 95%CI: 0.094-0.465) after accounting for other covariates (Table 3).

Discussion:

The total incidence of IPIs was 27.3% among research children, demonstrating that IPs are widespread in children in the study area who have diarrheal illnesses. Earlier research have demonstrated that IPs are connected with diarrheal illnesses, despite the causal association could not be confirmed in the current study [17, 18]. Several gastrointestinal pathogens could become more susceptible as a result of intestinal parasite infections [19].

The incidence of IPs discovered in this survey is less than the incidence detected in other investigations from Ethiopia's Jimma (65.8%) and Gondar (52.3%), as well as other nations like Cameroon (59.2%) and India (46.5%) [20, 21]. However, the total incidence of IPs discovered in this study is marginally greater than those discovered in Ethiopia

(26.6%) [22], Tanzania (15.1%), Mozambique (14.5%), and Nigeria (23.3%) [23-25]. These discrepancies may result from changes in the respondents' ages, personal hygiene habits, and parental socioeconomic position, in addition to seasonal fluctuations. In a survey performed in Addis Abeba, the incidence of IPs was found to be closely similar (27.5%) [26]. The pathogenic enteric protozoa *E. G. histolytica*, *C. duodenalis* and *parvum* are proven to lead to diarrhoea. In a survey by Mulatu et al. [22], The most common IP identified was *E. histolytica*/*dispar*/*moshkovskii*. Infants with diarrheal infections linked to *E. histolytica* are far more likely to be stunted and malnourished, according to research by Mondal et al. [27]. Since only traditional microscope was utilized to identify the amoebae, differences in the morphologically identical *Entamoeba* organisms were outside the purview of this investigation which agreed with the study by Mulatu et al. [22]. Prior results, however, indicated that in older patients in without the pathogenic *E. histolytica*, amebiasis may have been overprescribed [28, 29].

Giardia lamblia was the first and most common IP found in the current study (8%). Giardiasis is typically linked to unclean surroundings and inadequate water filtration. Infants with *Giardia* who are symptomatic frequently have nutritional deficiencies [22, 30]. Infections with *G. duodenalis* can cause acute disease manifestations in addition to cognitive loss [31]. Six percent, or nine infections, were found in children less than 24 months. Other regions have also documented earlier childhood exposures to *Giardia* [32, 33].

Infants in underdeveloped nations frequently contract *Hymenolepis nana* intestinal parasites [34, 35]. *Hymenolepis nana* was found in 7 (4.7%) of the youngsters in this investigation. Long-term effects on the prevalence of STH infections among preschoolers may

result from the recently implemented nationwide educational deworming program. However, due to reports of decreasing albendazole and mebendazole effectiveness towards *A. lumbricoides* and hookworms [36], it is critically necessary to evaluate the effectiveness of anthelmintic medications in the research region. The presence of worms contributes to the clinical signs that indicate STH infections [37]. Unfortunately, the degree of infection was not assessed in this investigation. Additionally, because just one wet preparation method was utilised to identify the parasites, the number of kids afflicted with parasitic helminths in this research may have been understated.

In this investigation, the incidence of IPs in children under 2 years was 27 (18%), but it was 9.3% in over 2 years. This variation is significant. The elder children's playtime interaction with faecal material polluted dirt may have exposed them to IPs, which may account for the increased incidence of IPs in infants under 2 years compared to children over than or equal to 2 years.

In a similar study done by Mulatu et al. [22], In contrast to the frequency of 51.1% amongst kids aged 2 years and older, 16.2% of infants younger than 24 months tested positive for IPs.

In this research, the incidence of IPs amongst EBF children and kids consuming supplemental foods in addition to breastfeeding was equal. Exclusive breastfeeding protects against major infectious agents in utero and lowers the likelihood of hospitalization for diarrhea [38]. Breastfeeding has been linked to a reduction in the incidences, prevalence, admissions, deaths from diarrhoea, and overall mortality, according to a previous review [39].

The limited sample size of kids in this research, which included 38% of kids who were no longer nursed and those who were breastfed with supplementary meals, may be the reason why the opposite findings for EBF were found.

With IP isolated incidences of 10 and 17.3%, respectively, of these, 36 (24%) began receiving supplemental meals before the age of six months, whereas 114 (76%) began at the 6th month. There was no clear differentiation in the incidence rates of IPs between infants who began consuming supplemental meals before the age of six months and those who did not.

This was consistent with a study done by Mulatu et al. [22] who stated that 72.2% of the survey respondents were youngsters who weren't longer being breastfed or who were being nursed with additional meals. Of these, 93 (81.6%) began receiving adequate nutrition at the sixth month, compared to 21 (18.4%) who began before the age of six months, with IP separation percentages of 33.3 and 29%, correspondingly. There was no discernible differences in the incidence rates of IPs between infants who began consuming supplemental meals before the age of six months and those who did not. The bulk of the youngsters in this research (92%) lived in urban areas and 86% of their homes consisted of no more than five people. There was a considerable distinction between children from urban regions (21.3%) and rural areas (6%) in terms of the incidence of IPs. Similar to this, there was a substantial difference between children whose families had 5 or more people (20%) and those whose families did not (<5 individuals) (7.3%). Other potential factors, such as hand washing after using the restroom, access to water, adequate food storage, good waste disposal in the community, and HIV status, may have a substantial impact on a child's risk of contracting IPs. Numerous studies supported these results [40, 41].

There was a statistically significant difference in the prevalence of IPs between children who had previously interacted with animals (6.7%) and those who had never interacted with animals (20.7%).

Limitations:

In this study, examines the historical, physiological, clinical, and epidemiological evidence to support a method of therapy for children's diarrhea that may be recommended for general acceptance. The small sample size was regarded as a drawback. The nutritional status of infants might well be harmed by certain intestinal protozoan parasites, and diarrhea is one of the most common reasons for death in kids who were severely malnourished.

Conclusion:

According to the current research, support the detailed analysis of current knowledge in the epidemiological, clinical, and physiological aspects of diarrheal illness. youngsters under the age of nine get diarrhea as a result of IPs and other causes. Use of fluid and nutritional therapy of acute diarrhea in childhood to a point where acute mortality can be reduced to nearly zero. Prior beginning empirical therapy for youngsters under the age of nine who arrive with diarrhea, parasitological exams must be taken into account and carried out. Young children's parents should get health advice on how to avoid diarrheal infections in general and IPs in specific.

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