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Epidemiology of Gastrointestinal Parasites among School - aged Children in Imo State, South Eastern Nigeria

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ABSTRACT

In order to identify the presence of gastrointestinal parasitic infection, and to determine the impact of some factors such as age, sex, location (rural and urban) and nutritional habits of children and also the occupation of their parents, this cross sectional study was carried out on 132 stool samples of primary school children in Okwelle, Onuimo (rural) and Owerri municipal(urban), Imo State, Nigeria. Using direct wet mount techniques(using physiological saline and lugol' iodine) to process the samples (faeces), 74(56.1) out of 132 samples collected were found positive for various gastrointestinal parasites with *E. histolytica* accounting 36.4%, *Ascaris lumbricoides*10%, *Trichuris trichuria* and Hookworm7.6%, *Gardia intestinalis* 4.5% and *Strongyloides stercolaris* 3.0% respectively. Cases of polyparasitism were also detected but no pupil had more than two parasite species. Infection was higher in male (64.8%) than female (44.1%), people living in the rural areas (58.5%) than those in the urban centers (48.0%), lower age group (76%) than higher age group (45%). It is concluded that sanitary measures and de- worming programs be conducted in primary schools especially those in rural areas to decrease the rate of intestinal parasite infection.

Introduction

Gastrointestinal parasites are parasites found in the gastrointestinal tract, and they are among the most common human infections which are distributed throughout the world with high prevalence rates in developing countries due to deficiency of sanitary facilities, unsafe human waste disposal system, inadequacy and lack of safe water supply, and low socio-economic status (Omudu, 2003) Wadhwa *et al* (2011) have shown high prevalence of gastrointestinal parasites in the cattle and buffaloes in India. People of all ages are affected by this cycle of prevalent parasitic infections (Stekeete, 2003), however, while a whole populations will be geographically at risk, children are observed to disproportionally carry the greatest burden of infection (Brooker *et al*, 2006). This disproportion has behavioral, biological and environmental bases. Children tend to be more active in the infected environment and rarely employ good sanitary behaviors. Frequently, these potential carriers are crowded together for large periods of time (e.g., schools, orphanages or slums), increasing the likelihood of transmission or environmental contamination with the parasite. Gastrointestinal parasitic infection was estimated to affect 3.5 billion persons and causes clinical morbidity in approximately 450 million (WHO, 2000). The major intestinal parasitic infections (IPIs) of global public health concern are the protozoal *Entamoeba histolytica* and *Giardia intestinalis* and soil transmitted helminthes *Ascaris lumbricoides, Trichuris trichura* and hookworm(WHO, 2000). Gastrointestinal parasitic infections are considered a public health problem of worldwide importance for reasons of their high prevalence, widespread distribution and effect on health [Stephenson *et al*, 2000]. Morbidity and mortality caused by gastrointestinal parasitic infections is usually more pronounced in children compared to adults due to their higher nutritional requirement and less mature immune system [Guyatt, 2000). Apart from causing morbidity and mortality, infections with intestinal parasites have been associated with stunting, physical weakness and low educational performance of schoolchildren [Nokes & Bundy, 1994]. Parasitic infections are governed by behavioral, biological, environmental, socioeconomic and health systems factors. Local conditions such as quality of domestic and village infrastructure; economic factors such as monthly income, employment and occupation and social factors such as education influence the risk of infection, disease transmission and associated morbidity and mortality [Wang *et al*, 2009]. The prevention of parasitic infection in man include the following stages, reduction of the source of infection by therapeutic measures, education, sanitary control of water, food, living and working conditions and waste disposal, destruction and or control of reservoir host and vectors, (Neva and Brawn, 1994). The aim of this study is to determine the prevalence of gastrointestinal parasitic infection in school children living in the rural and urban areas and the socio-demographic, gender and other predictor of gastrointestinal parasitic infection risk in the children.

Materials And Method

Study Area

This study was carried out in Owerri Municipal Area (urban) and Okwelle in Onuimo Local Government Area (rural) both in Imo State, South Eastern Nigeria. Imo State is located between latitude $5^0$12 and $5^0$56 North of equator and longitude $6^0$38 and$7^0$25 East of the Greenwich meridian. It comprises of three geopolitical zones; Owerri, Orlu, Okigwe. Owerri is the capital city and main commercial centre of Imo State. Imo State generally has a good network of roads linking the urban centers to rural areas. It is densely populated with higher concentration of youths and middle aged people in the urban centers. In the recent times, the level of environmental sanitation appears to be

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dropping especially in the urban areas. Many residential building in the urban centers and commercial areas do not have toilet facilities and people defecate indiscriminately on the road-side, drainage gutters, etc. Heaps of refuse are left un- disposed for days to weeks in some parts of the urban centers like owerri. Food vendors and snacks dealers amongst other edible commodities are commonly found displayed and sold near such un-disposed heaps of waste.

Research Respondent

The respondents used in this study were primary school pupils, aged 5 to 14 years selected from primary schools within Owerri Municipal Council and Okwelle-Onuimo Local Government. The respondents were randomly selected from two primary schools in each of the study areas. The headmasters/ headmistresses of the various schools were approached and objective of the study explained to them. Their consent and willingness to allow their pupils participate in the study were sought for. The class teachers of the various schools that gave their consent to participate in the study were used as field assistants to recruits their pupils and collect samples from them. A total of 150 respondents comprising of 60 from Owerri Municipal council and 90 from Okwelle were selected for the study.

Test Samples

The samples used for this study was early morning stool samples collected from the selected respondents.

Instrument for Data Collection

The instrument used in collection of data in this study is a structured questionnaire comprising of two sections; section A-socio-demographic data and section B-nutritional habit. Section A comprises of six questions while section B has seven questions.

Pre - testing of instruments for data collection

The questionnaires used for this study were pre-tested at Ihiagwa and Nekede in Owerri West Local Government Area. Ten primary school pupils from Ihiagwa and Nekede were selected and initial draft of the research questionnaires were administered to them. The difficulties encountered in completing the questionnaire and useful suggestions made by the pre-test field assistants were used to prepare the final questionnaire used for the study.

Administration of Questionnaire

The questionnaires were administered to the respondents by person to person contact. The field assistants administered the questionnaires to the selected pupils and assisted them to complete it. The completed questionnaires were collected on the spot after completion.

Sterilization of Materials

The materials for this study were sterilized using standard techniques as in Cheesebrough (2002), Obiajulu and Ozumba(2009). Glass wares (test tubes, beaker, etc.) were sterilized in the hot air oven at 160^0 for 1hr. Working areas (bench tops and film cupboard) were cleaned with disinfectant (Purit) and covered with 75% ethanol. Sterile disposable hand gloves and facemask were worn intermittently to ensure aseptic condition. Commercially prepared disposable specimen containers (Seward) were used.

Collection of Samples

Disposable sterile containers bearing the respective index numbers, age, gender of respondents who have completed and returned their questionnaires were given to the field assistant who issued them to the pupils before dismissal of school and instructed them to use sterile swab stick provided to collect a little portion of their early morning feces the next day and put inside the specimen container.

The pupils were instructed to submit the collected samples to the field assistants on arrival to the school on day of sample collection. The collected samples were transported in a suitable plastic container to the Microbiology Laboratory of Federal University of Technology Owerri where they were analyzed within 3 hour of collection.

Processing and Parasitological Examination of Samples

Each sample was analyzed parasitologically for stool analysis using the direct wet mount technique as in Cheesebrough (2002), Obiajuru and Ozumba (2009). A little portion (about 0.5g) of each sample was emulsified in 1ml of physiological saline in a sterile test tube using disposable swab stick. The emulsified sample were properly labeled and covered with a plastic cap.

The physical (microscopic) appearance and nature of each stool samples were observed and recorded. Disposable sterile Pasteur's pipette was used to collect a portion of emulsified sample of each research specimen. A drop was placed on a clean grease free slide and covered with a cover slip. It was placed on a microscope stage and examined microscopically using low power(x45) objectives. Organisms observed in each sample were recorded.

Another portion of each emulsified specimen was placed on a clean glass slide and a drop of Lugol's iodine was added to it and covered with a cover slip. It was examine microscopically using low power(x10) and high power (x45) objectives.

Analysis of Data

The data obtained from the study were analysed statistically using simple percentage and chi-square analysis as in Philips (2002).

Result

Out of 150 pupils selected for the study, 134 (89.3%) completed and returned the questionnaire. 2 (1.5%) out of 134 that returned the questionnaire did not produce stool samples. 132 pupils submitted both stool samples and completed questionnaires and these were used for the study.

Of the 132 pupils used for the study, 68 (51.5%) were females and 64 (48.5%) were males. Out of 60 respondent selected in Owerri (urban) only 50 (83.3%) returned completed questionnaire and stool samples. Similarly, 82 (91.1%) out of 90 pupils selected at Okwelle (rural), returned completed questionnaire and stool samples.

Prevalence of Intestinal Parasite

The result of this study shows that out of 132 pupils examined, 74(56.1%) were infected with intestinal parasites.

Gender related prevalence of infection

Out of 64 male pupils examined, 44 (68.8%) were infected with intestinal parasite while 30 (44.1%) out of 68 female pupils examined were infected with intestinal parasite. Specifically, 18 (28.1%) of male pupils were infected with protozoa, 18 (28.1%) with helminthes parasite. while 8 (12.5%) with both protozoa and helminthes. Out of 68 female pupils, 18 (26.5%) were infected with protozoa parasite, 2 (2.9%) with helminthes and 10 (14.9%) had mixed infections of helminthes and protozoa.

Generally the prevalence of intestinal parasite was higher (68.8%) amongst males than in female pupils (44.1%). Analysis of the data using chi square showed significant difference ($P < 0.05$) in the prevalence of infection between male and female pupils.

Table 1 summarizes the gender related prevalence of intestinal parasites. The prevalence of intestinal protozoan parasite (27.3%) was higher than that of intestinal helminthes

(15.2%). Similarly, the prevalence of single (helminthes and protozoa) intestinal parasitic infection (42.4%) was higher than that of mixed infection (both helminthes and protozoa) (13.8%). As shown, a total of 58 (43.9%) pupils had no intestinal parasite infection. These comprised of 20 (31.3%) males and 38 (58.9%) females.

Age related prevalence of infection

The result of this study shows that out of 82 pupils ages 5 to 8 years, 38 (46.3%) were infected by *E. histolytica,* 8(9.8%) by hookworm, 6(7.3) with *A. lumbricoides,* 4(4.9%) by *G. intestinalis* or *T. trichuria* respectively and 2(2.4%) with *Strongyloides stercolaris* .

Out of 28 respondent aged 9 to 12 years, 8(28%) were infected by *E. histolytica,* 4(14.3%) by *A. lumbricoides* and *T. trichuria* respectively and 2(7.1%) by *G. intestinalis* and hookworm respectively

Out of 22 pupils aged above 12 years, 4(18.2%) were infected by *Ascaris,* 2(9.1%) by *E. histolytica, T. trichuria and Strongyloides* respectively. It can be observed that the prevalence rate increased significantly as a result of mixed infection (18).

Table 2 summarizes the age related prevalence of intestinal parasite in the study area. As shown, the most prevalent parasite was *E. histolytica*(36.4%) followed by *Ascaris* (10.6%), and the least prevalent parasite (3.0%) was Strongyloides. Analysis of the data using chi square showed significant difference ($p<0.05$) in the prevalence of intestinal parasite between the different age groups. Prevalence of infection was higher amongst the younger aged group (5-8years), than that of the older age groups (9-12years and above 12years)

Community Related Prevalence of Intestinal Parasite

Out of 50 pupils examined from Owerri Municipal, 26(52%) were infected with intestinal parasite. In Okwelle, 48(58.5%) out of 82 pupils were infected with intestinal parasites. There were a total of 18 subjects with mixed infection made up of 6(12) from Owerri Municipal and 12(14.6).

Table 3 summarizes the distribution of intestinal parasites among urban and rural communities studied. As shown 16(32%) out of 50 pupils were infected with *E. histolytica* in Owerri, 8(16%) with hookworm and 4(8%) with *Ascaris* and *T. trichuria* respectively.

In Okwelle (rural), 32(39.0%)pupils were infected with *E. histolytica,* 10(12.2%) with Ascaris, 6(7.3%) with *G. Intestinalis* and *T. trichuria* respectively, 4(4.9%) with *strongyloides* while 2(2.4%) were infected with hookworm.

Analysis of the data using chi square shows significant difference ($p<0.05$) in the prevalence of infections between urban and rural communities. Prevalence of infection was higher (58.5%) in the rural than urban area (48.0%).

Prevalence of gastrointestinal parasites base on parent's occupation

The result showed that out of 34 pupils whose parents were traders, 12(35.3%) were infected by *E. histolytica,* 6(17.16%) by *A. lumbricoides,* 4(11.8%) by *T. trichuria* and 2(5.9%) by hookworm.

Out of 30 pupils whose parents were farmers 12 (40%) were infected by *E. histolytica,* 6(20%) by *A. lumbricoides,* while 2(6.7%) were infected by *G. intestinalis, T. trichuria,* hookworm and *Strongyloides starcolaris* respectively.

Out of 24 pupils whose parents were civil servants, 4(16.7%) were infected by *E. histolytica,* and 2(8.3%) were infected by *G. intestinalis, T. trichuria* and *Strongyloides stercolaris* respectively.

Out of 44 pupils whose parents were artisans, 20(45.5%) were infected by *E. histolytica,* 6(13.6%) by hookworm and 2(4.5%) by *A. lumbricoides, G. intestinalis and T. trichuria respectively.*

Table 4 summarizes the occupational distribution of intestinal parasitic infection amongst primary school pupil in Imo State. As shown; infection was higher amongst pupils whose parents are artisans, followed by pupils whose parents were farmers, traders and civil servants.

Comparative analysis of the effect of nutritional habits on the prevalence of intestinal parasite

Table 5 shows the prevalence of gastrointestinal parasites based on the nutritional habits. Out of 56 pupils who usually eat fresh vegetables, 40 (%) pupils were infected. Of these numbers, 20 (%) were infected with *E. histolytica,* 6(%) with *A. lumbricoides,* 3(%) with *G. intestinalis,* 1() with *Strongyloides stercolaris* while 5(%) with hookworm and *T. trichiura* respectively.

Out of 40 pupils who usually eat fruit at school, 27(%) were infected, of these 16(%) were infected with *E. histolytica,* 2 () with *G. intestinalis, 4() with A. lumbricoids* and 2() with *T. trichiura,* 2(%) with hookworm, 1(%) with *Strongyloids stercolaris.* Out of 20 pupils who eat fast foods (from local fast food vendors), 13(%) were infected with intestinal parasites. Of these, 7(%) were infected with *E. histolytica,* 2(%) with *A. lumbricoids* and 1() with hookworm and 3(%) with *T. trichiura*. Fourteen (14) pupils out of 132 eats confectionaries as snacks at school, of these 11(%) were infected by gastrointestinal parasites. Of these numbers, 6(%) were infected by *E. histolytica,* 2(%) with *A. lumbricoides,* 2(%) with Hookworm while 1 (%) with *S. stercolaris* while 1() with *G. intestinalis.* Among 2 pupils that usually eat local snacks, 1(50%) were infected with *Strongyloides stercolaris*.

Discussion

This study investigated the prevalence and risk factors of gastrointestinal parasite infections in rural (Okwelle - Onuimo) and urban (Owerri municipal) communities of Imo state. It was hypothesized that boys would be at increased risk compared to girls and younger children would be at increased risk for gastrointestinal parasites compared to older children, since their behavior would make them more likely to come in contaminated water, dirt, food, feces and sources of infection. It was also hypothesized that children in rural area were at increased risk of infection compared to children in the urban area. The prevalence of gastrointestinal parasite infection of human may be related to several human factors such as age, sex, occupation, method of defecation and habitats. The results revealed that out of 132 pupils examined 74(56.1%) of pupils were having one or more of the following parasites present in their stool samples: *Entamoeba histolytical, Ascaris humbricoides, Trichuris trichiura, Giardia intestinalis, Strongyloides starcolaris.* The most frequently found parasite in the study was *E. histolytica* followed by *Ascaris lumbricoides, Trichuris trichiura,* hookworm, *Giardia intestinalis* and the least is *strongyloides starcolaris.* This result is in line with other finding in the south-eastern Nigeria which recorded 55.2. % prevalence(Woken *et al*, 2001). However, the higher prevalence of protozoa (especially *E. histolytica)* compared to helminthes might be due to the fact that cyst are more resistant to harsh weather than eggs of helminthes. High prevalence of intestinal parasite infestation is apt to occur in low socioeconomic conditions characterized by inadequate water supply and poor sanitation. The distribution of parasites among sex group showed that more males were infected than females.

Table 1. Gender Related Prevalence of Gastrointestinal Parasites

Sex	Number examined	Number infected (%)			Number uninfected
		Protozoa	Helminths	Both	
Male	64	18 (28.1)	18(28.1)	8(12.5)	20(31.3)
Female	68	18 (26.5)	2 (2.9)	10(14.7)	38(55.8)
Totals	132	36 (27.3)	20 (15.2)	18 (13.6)	58 (43.9%)

Table 2. Age-Related Prevalence of Intestinal Parasites

Age (years)	Numbers examined	Number infected (%)					
		Entamoeba histolytica	*Giardia intestinalis*	*Ascaris lumbricoides*	*Trichuris trichuria*	*Hookworm*	*Strongyloides stercolaris*
5-8	82(62.1)	38(46.3)	4(4.9)	6(7.3)	4(4.9)	8(9.8)	2(2.4)
9-12	28(21.2)	8(28.)	2(7.1)	4(14.3)	4(14.3)	2(7.1)	-
Above 12	22(16.7)	2(9.1)	-	4(18.2)	2(9.1)	-	2(9.1)
Total	132	48(36.4)	6(4.5)	14(10.9)	10(7.6)	10(7.6)	4(3.0)

Table 3. The distribution of gastrointestinal parasites among urban and rural communities

Community	No. Examined	No. Infected (%)						
		E. histolytica	G. *intestinalis.*	A. *lumbricoides*	T. *trichiura.*	*Hookworm.*	S. *stercolaris*	Mixed infection
Urban	50(38.0)	16(32.0)	_	4(8.0)	4(8.0)	8(16)	_	6(12)
Rural	82(62.1)	32(39.0)	6(7.3)	10(12.2)	6(7.3)	2(2.4)	4(4.9)	12(14.6)
Total	132	48(36.4)	6(4.5)	14(10.9)	10(7.6)	10(7.6)	4(3.0)	18(13.6)

Table 4. Parent's Occupational Related Prevalence of Gastrointestinal Parasite

Parents occupation	No. examined	No. of infection (%)					
		Entamoeba histolytica	*Giadia intestinalis*	Ascaris *lumbricoides*	Trichuris *trichiura*	*Hookworm.*	*Strongyloides stercolaris*
Trader	34	12(35.29)	-	6(17.65)	4(11.76)	2(5.88)	-
Farmer	30	12(40.00)	2(6.67)	6(20.00)	2(6.67)	2(6.67)	2(6.67)
Civil servants	24	4(16.67)	2(8.33)	-	2(8.33)	-	2(8.33)
Artisian	44	20(45.45)	2(4.55)	2(4.55)	2(4.55)	6(13.64)	-
Total	132	48(36.36.)	6(4.55)	14(10.61)	10(7.58)	10(7.58)	4(3.03)

Table 5. The Effect of Nutritional Habits on the Prevalence of Intestinal Parasite

Type of food	*E. histolytica*	*A. lumbricoides*	Hookworm	*S. stercolaris*	*G. intestinalis*	*T. trichuria*	No uninfected	No infected
Fresh vegetable(56)	20(35.71)	6(10.71)	5(8.93)	1(1.79)	3(5.36)	5(8.93)	16(28.57)	40(71.43)
Fruits(40)	16(40.00)	4(10.00)	2(5.00)	1(2.50)	2(5.00)	2(5.00)	13(32.50)	27(67.50)
Fast food(20)	7(35.00)	2(10.00)	1(5.00)	-	-	3(15.00)	7(35.00)	13(65.00)
Confectionaries(14)	5(35.71)	2(14.39)	2(14.29)	1(7.14)	1(7.14)	-	3(21.43)	11(78.57)
Local snacks(2)	-	-	-	1(50.00)	-	-	1(50.00)	1(50.00)

Similar results were reported by Narayan *et al* (2011) and Rufai and Awi-Waadu (2006) that more males than females were affected. This agrees with the finding of Ikon (1999) during an epidemiological study of gastrointestinal helminthes among pupils in Urban and rural communities in Nigeria. This high prevalence associated with males may be due to the fact that they are more often engaged in predisposing activities such as football and also playing in stream and ponds. The findings of this study shows that children under 5-8 years age group has higher prevalence of gastrointestinal parasites (76%) compared to the 9-12 and above 12 years age group which is 71% and 45% respectively, although the result is not significantly different. This work supports the report of Damen *et al* (2011) that lower age group have higher prevalence rate of infection than older people in the northern part of Nigeria. This can be because pupils in this age group often spend more of their leisure time outdoors, playing and/ or foraging in garbage dumping and eating discarded food remains on the street. They are also more often in contact with sand and eat indiscriminately with unwashed hands. Compared to lower aged group, the higher age group low prevalence of infection observed may be attributed to the fact that they become more hygienic-conscious about their look and hence are able to avoid as much as possible what will lead to one being infected. This is consistent with the finding observed in Kaduna (Luka *et al*, 2000) and Abia state (Ukpai *et al*, 2003).

As shown in the result, the prevalence of gastrointestinal parasite is higher in the rural communities (58.5%) compared to that of the urban communities (52%). Drinking unsafe water; association with domestic animal; playing in dirty environment; working and walking barefoot result to higher exposure of children to infective stage of gastrointestinal parasites. All this accounts for the high prevalence of these parasites in the rural communities.

The result also showed that the prevalence of infection was higher(80%) among pupils that buy food from fast food vendors, followed by those that usually eat fruits(62%), local snacks (50%), while the least prevalence are in those that eat confectioneries(43%). The high prevalence amongst pupils that eat fast food may be because the food was prepared under dirty environment, example cooking beside drainage gutters and near defecation areas, using spoilt ingredients and unsafe water which expose the food to gastrointestinal parasites.

Fruits can be eaten unwashed and also with dirty fingers. This contributes to the high prevalence among those that usually eat fruits. Compared to others, confectioneries are prepared under good environmental conditions, packaged with hygienic packets and also are prepared with high temperature which helps to eliminate most of the parasites. But these confectioneries could have been eaten with dirty finger which accounts for the infection rate. These are consistent with the result that of Ogbuagu *et al* (2008). However, the effective treatment of most of these tropical parasitic diseases especially gastrointestinal infections depends on a whole lot of prompt diagnosis. The capability of rapidly diagnosing the disease and identifying its causative agent is critical to combat diseases and halt epidemics (Wadhwa *et al*, 2012 A). Recent technological developments have led to the proliferation of new, rapid diagnostic tests that hold promise for the improved management and control of infectious diseases (Wadhwa *et a*l, 2013 and Wadhwa *et al*, 2014). Such new technologies include microfluidics (Wadhwa et al. 2012 B) and "Lab-on- Chip" (Liu *et al*, 2011) as examples of promising new technologies and innovations that can underpin development of laboratory-free diagnostic devices for these gastro-intestinal parasites in animal husbandry. The present data obtained from this study, can serve as baseline prevalence data for gastrointestinal parasitic infection amongst school fed children, which will be useful for the future assessment of the significance of prevalence value of gastro intestinal parasite in various age group and different sex.

Conclusion and recommendation

It is well known that the prevalence of gastrointestinal parasitic infections in children are generally high, especially, those of lower aged group and those from the rural communities. This can be attributed to the fact that these set of children usually stay outdoors, play in ponds and mud water, walking barefooted, which exposing them to contaminated soil and thereby increasing their risk of infection.

Also children who eat outside their home, those who buy food from local food vendors, and those who eat fruits and fresh vegetables; all stands a high risk of infection. This may be due to the manner of preparing food in dirty environment, not washing the fresh vegetable with clean water before eating, and also not washing hand after using the toilet and before eating. If these infections are left untreated, serious complications and even death may occur. Typical public-health interventions (such as the provision of clean water, community health education, observation of food hygiene, and maintenance of functioning sanitation systems) are essential to long-term control in a community should a top priority in our local communities.

It is therefore recommended that local health workers/officers should visit schools regularly (especially those in rural communities) for routine de - worming and health education to improve sanitary conditions like regular hand washing. Parents should be also informed about the sign, symptoms and prevention of these parasitic infections.

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