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Retrospective and Prospective Studies of Gastro-Intestinal Helminths of Humans and Dogs in Makurdi, Nigeria

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----------**ABSTRACT**----------
A five-year retrospective and one-year prospective studies of gastrointestinal (GIT) helminths was carried out in humans and dogs in Makurdi, Nigeria. Data from 534 individuals presented at the Federal Medical Centre (FMC) and 103 faecal samples from dogs at the Veterinary Teaching Hospital (VTH), University of Agriculture, Makurdi from 2007 to 2014 were used. The overall prevalence of zoonotic GIT helminths in humans was 76.21% (407/534) and 56.31% (58/103) in dogs. The differences in the prevalences in humans based on sex,ethnicity and age were not statistically significant (χ^2, P< 0.05). However, the test of individual factor (coefficient) on GIT helminthes in humans showed that hookworms prevalence was dependent on age (P = 0.001), Ascaris lumbricoides was dependent on ethnicity and age (P = 0.000 and 0.005), Taenia spp. prevalence was dependent on age and sex (P = 0.007 and 0.005), and Strongyloides stercoralis prevalence was dependent on age (P = 0.04). The prevalence in dogs depended on age and breed (χ^2,P < 0.05) but not on sex (χ^2,P > 0.05). Hookworms, Taenia spp and Trichuris vulpisoccurred in humans and dogs. Hookworms were the most common helminth of both humans and dogs. Individual factor (coefficient) on the effect of risk factors on specific helminths is essential in understanding the epidemiology of each helminth. Attention should be paid to control measures in man anddogs.

Keywords: *Prevalence, Helminths, Risk factors, Makurdi.*

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I. INTRODUCTION

A large number of diseases that are endemic in sub-Saharan Africa have been overlooked even by local health authorities who have along with international health systems, made these diseases to be labelled as neglected tropical diseases (NTD) (Hotez *et al*., 2008; Hotez and Kamath, 2009). A vast majority of these diseases affect mostly the very poor and are often co -endemic with malaria and HIV/AIDS (Hotez, 2011). The typical abandoned diseases are zoonotic gastro-intestinal, soil-transmitted helminths infections (Hotez *et al*., 2007, 2008).

These infections are prevalent in Nigeria, especially in children living where adequate water and sanitation facilities are lacking (Abah and Arene, 2015, Odinaka *et al*., 2015). It has been observed that children living under such conditions can be chronically infected with several species of helminths (Hotez *et al*., 2008; Usip and Mathew, 2015). Chronic helminth infections result in anaemia, stunted growth, under-nutrition, reduced work efficiency and poor cognitive development (long-term disability and poverty) (Hotez *et al*., 2007, 2008). This ignored morbidities enhance malaria (Mwangi *et al*., 2006).

The high prevalence rates haveled to the estimation of the worm burden using prevalence, (Usip and Matthew, 2015), instead of the classic measure by eggs per gram (EPG) of faeces and its association with morbidity (Hotez *et al.*, 2008). Dogs have been implicated in the transmission of some human GIT heminths (Bownan *et al*., 2010; Deplazes *et al*., 2011; Ogbolu *et al*., 2011; Traversa *et al*., 2014). Contamination of the environmentdue to poor sanitary facilities and a high dog population prompted the study which should remind health authorities about the ever present status of these neglected diseases in Nigeria.

II. MATERIALS AND METHODS

Retrospective and prospective studies of zoonotic GIT helminthes of humans and dogs were carried out at The Federal Medical Center (FMC) and Veterinary Teaching Hospital, (VHT), University of Agriculture, Makurdi, respectively. The case-control study involved retrieving data from the general out-patient department (GOPD), the medical records archive and laboratory sections of the hospital from January, 2007 to December 2012. The prospective study was carried out by systematically collecting faecal samples per rectum from dogs presented at the VTH Makurdi every Tuesday and Thursday from April 2013 to March 2014. The faecal samples were analysed using the salt floation technique (Zajac and Conboy, 2012).

Age, sex, ethnic group and type of parasite were the parameters used for retrieving data in the retrospective study while age, sex and breed were used in the prospective study. A sample size of 310 was arrived at using the method of Thrushfield (1995). Ethical clearance to conduct the study was obtained from the Ethical Committee, FMC Makurdi. The data generated from the study was analysed using the Statistical Package for Social Sciences (SPSS) for windows version 20.0. The Chi-square ((χ^2) was employed to test for association between variables. Chi-square test of model coefficient for individual helminths was used to ascertain whether the prevalence of each helminth depended on specific risk factors. Where dependence was demonstrated, the test of individual factor coefficient was carried out to determine the significance of each risk factor to the prevalence of specific helminths. In all analyses statistical significance was taken to be at ($p < 0.05$).

III. RESULTS

A total of 534 cases were retrieved for the five years retrospective study. The overall prevalence of zoonotic GIT helminths in humans at the FMC was 76.21% (407/534). The year 2009 had the highest prevalence rate of 100% (Table 1). The distribution of the prevalence based on sex was 57.5% (234/407) for males and 42.5% (173/407) for females. The difference was not statistically significant (p.>0.05). The 11-20 age group had the highest prevalence rate of 86.7% (91/105). The difference was not significant (p>0.05).The distribution based on ethnicity was 58.96% (24/407) Tiv, 15.72% (64/407) Idoma and 25.3% (103/407) other Nigerian ethnic groups. The difference was not significant (p>0.05) (Table 2).

Table 1. Yearly prevalence and types of zoonotic helminths encountered at the FMC Makurdi (2007-2012)

Number Examined/ Year	H. worm **(No. +ve)**	*Ascaris* **(No. +ve)**	*Taenia* **(No. +ve)**	*Trichuris* (No. +ve)	*S. **S**tercoralis* **(No. +ve)**	*S. **M**ansoni* **(No. +ve)**	NP
65/2007	29	10	3	8	0	3	**53 (81.53)**
162/2008	50	21	14	6	10	0	**101 (62.34)**
93/2009	49	23	9	5	8	0	**93 (100)**
90/2010	33	16	11	0	10	0	**70 (77.77)**
61/2011	17	6	3	9	7	0	**42 (68.85)**
63/2012	26	7	0	2	8	4	**47 (74.60)**
534	**204 (50.12)**	**83 (21.37)**	**40(9.09)**	**30 (7.37)**	**43 (10.31)**	**7 (1.71)**	**407 (76.21)**

NP= Number positive. The figures in parenthesis are percentages calculated from column and row totals

Table 2. Distribution of Zoonotic helminths in humans Presented at FMC Makurdi (2007-2012)

Variable		No. Of Examined	Prevalence Status	Chi-Square	P-Value
Sex					
	Male	289	234 (57.5 %)	102.375	0.809
	Female	245	173 (42.5 %)		
Ethnicity					
	Tiv	307	240 (78.18%)	2.381	0.304
	Idoma	84	64 (76.19%)		
	Others	144	103 (71.52%)		
Age					
	0-10	89	62(69.70)	102.375	0.6966
	11-20	105	91 (86.67)		
	21-30	110	90 (81.81)		
	31-40	114	90 (78.94)		
	41-50	67	42 (62.68)		
	51-60	35	19 (54.28)		
	>60	14	13 (92.86)		

However, the Chi-square test of model coefficient for individual helminths showed that the prevalence of hookworms, *Ascaris lumbricoides*, *Taenia spp.* and *Strongyloides stercoralis* in humans depended on risk factors (Table 3). The test of individual factor (coefficient) on GIT helminths showed that the prevalence of hookworms was dependent on age (p=0.001), but independent of sex and ethnicity (p=0.140 and 0.954) respectively. *Ascaris lumbricoides* prevalence was dependent on ethnicity and age (p=0.000 and 0.005) but independent of sex (p=0.545). *Taenia spp.* prevalence was dependent on age and sex (p=0.007 and 0.005) but not ethnicity (p=0.366). Strongyloides *stercoralis* prevalence was dependent on age (p=0.004) but not sex or ethnicity (P=0.05 and 0.366) (Table 4).

Table 3. Chi-Square test of Model Coefficients on Hookworms, *Ascaris* spp, *Teania* spp and *Strongyloides* spp.

Helminths		**Chi-Square**	**DF**	**Sig**
Hookworms	Block	72.279	3	0.007
	Model	72.279	3	0.007
***Ascaris* spp**	Block	102.375	3	0.005
	Model	102.375	3	0.005
***Teania* spp**	Block	89.955	3	0.02
	Model	89.955	3	0.02
***Strongylodies* spp**	Block	76.955	3	0.02
	Model	76.955	3	0.02

Table 4. Test of Individual factor (Coefficent) Hookworms, *Ascaris* spp, *Teania* spp and *Strongyloides* spp

Helminths	**Variable**	**B**	**S.E**	**Wald**	**Df**	**Sig.(P)**	**Odds ratio**
Hookworms	Sex	.236	.160	2.183	1	.140	0.790
	Age	.007	.023	.102	1	.001	1.903
	Ethnicity	.008	.135	.003	1	.954	0.992
	Constant	.095	.404	.055	1	.814	1.100
Ascaris spp	Sex	-.130	.215	.367	1	.545	.878
	Age	.000	.030	.000	1	.005	1.719
	Ethnicity	-.011	.180	.004	1	.000	1.590
	Constant	-1.426	.539	7.007	1	.008	.240
Teania spp	Sex	.066	.267	.061	1	.005	1.468
	Age	-.099	.038	.050	1	.007	1.301
	Ethnicity	-.207	.229	.817	1	.366	.813
	Constant	-8.444	.672	7.524	1	.006	.158
Strongyloides Spp	Sex	.066	.267	.061	1	.05	1.68
	Age	-.009	.038	.050	1	.04	1.801
	Ethnicity	-.207	.229	.817	1	.366	.813

The helminths encountered in humans included hookworms (*Ancylostoma spp.*) 50.12%, *Ascaris lumbricoides* 21.37%, *Taenia spp.* 9.09%, *Trichuris vulpis* 7.37%, *Strongyloides stercoralis* 10.31% and *Schistosoma mansoni* 1.71% (Table 1)

In the prospective study the overall prevalence of zoonotic GIT helminths in dogs was 56.31% (58/103). The prevalence was dependent on age and breed ($p<0.05$) but not on sex ($p>0.05$). Hookworms were the most commonly encountered helminths accounting for 89.7% (52/58),*Toxocara canis* 6.9% (4/58), *Trichuris vulpis* 1.72% (1/58), and *Taenia spp.* 1.72% (1/58) (Table 5).

Table 5. Prevalence of Zoonotic Helminths Parasites Of Dogs In UAMVTH (March 2012-February, 2013)

Variable		No Examined	No Positive	Prevalence	Odds ratio	Chi-Square	P-value
Age	0-2	72	45	(88.23%)	1.3	12.000	0.625
	2-4	9	5	(9.80%)	1.6		0.500
	4-6	3	-	-	-		
	>60	2	1	(1.96. %)	-		
Breed	Mongrel	31	20	64.52%	-	2.8876	0.0893
	Exotic	55	25	29.33%	-		
Sex	Male	50	31	60.78%	1.2	48.000	0.56
	Female	38	17	33.33%	-		
Helminths	Hookworms	103	52	89.66%	-		
	T. canis	103	4	6.89%	-		
	T. vulpis	103	1	1.72%	-		
	Taenia spp.	103	1	1.72%	-		

No of dogs infected with helminths = 58

Overall prevalence of helminths in dogs = 58/103 (56.31%)

IV. DISCUSSION

The study recorded high prevalence rates of GIT helminths in both humans and dogs at 76% and 56 % respectively. The high prevalence in humans has confirmed the endemic nature and the burden of these infections in Makurdi, Nigeria, as has been reported (Hotez *et al*, 2011). The prevalence rate in humans was higher than reports by Odinaka *et al*. (2015) and Abah and Arene (2015) from Imo and Rivers States respectively. The prevalence in dogs has demonstrated that dogs can potentially contaminate the environment leading to transmission to humans. The prevalence rate in dogs was higher than that reported by Onyeabor (2014) in Umuahia, Abia State but similar to the report by Kutdang *et al*. (2010) in Jos, Plateau State.

Chi-square analysis of the entire data from the retrospective study showed that sex, ethnicity and age were not significant factors on the prevalence ($p>0.05$). However, the test of individual factor (coefficient) on specific GIT helminths showed that hookworms, *Ascaris lumbricoides*, *Taenia* spp and *Strongyloides stercolaris*

prevalence depended one age. The dependence on age is consistent with the epidemiology of GIT soil-transmitted helminthes in the tropics (Hotez *et al.,* 2008) and demonstrates the need to carry out studies on individual helminthes infections in other to bring out the effects of various factors. The dependence on age maybe because children have more access to the soil from playing and observe less hygienic practices. *Ascaris lumbricoides* prevalence was also shown to be statistically dependent on ethnicity ($p>0.05$). Sampling bias on children of poor Tiv ethnic group could have accounted for this since the FMC is in Makurdi where children of poor Tiv ethnic group have access.

The finding by the study that hookworms, ascariasis, trichuriasis, schistosomiasis and taeniasis were identified in humans with hookworms being the most prevalent underlines the position of Nigeria as the leading sub-Saharan African country with the greatest burden of disease from soil transmitted helminths as reported by Hotez and Karmath, (2009), and Hotez, (2011). The high prevalence may be due to the moist sandy nature of Makurdi soils which reportedly favours larval transmission and the high population of dogs. (Omudu *et a*l.,2010; Hotez, 2011; Babamale *etal*., 2015; Babamale and Ogbomoiko, 2016) which supports zoonotic transmission. The helminths identified were similar to the ones in dogs and from other reports. (Hotez *etal*., 2007; Hotez, 2011; Babamale *etal*., 2015; Babamale and Ogbomoiko, 2016), and were zoonotic in nature as reported by Abere *et al* (2013).

The study has reported a high prevalence of similar GIT helminths in man and dogs with hookworms being the most prevalent infection.in Makurdi, Nigeria. We therefore concluded that dogs have a significant potential in the transmission of the infections to humans. Also, individual studies of different GIT helminths are necessary to elucidate each helminths epidemiology. Control of the infections in dogs is essential to reducing the burden of infections in man. We recommend large scale annual mass de-worming campaigns and echo Hotez (2011) call of linking neglected tropical disease to malaria and HIV/AIDS initiatives in Nigeria.

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