Short Communication

Revista da Sociedade Brasileira de Medicina Tropical 45(5):646-648, Sep-Oct, 2012

Enterobius vermicularis infection is well controlled among preschool children in nurseries of Taipei City, Taiwan

Tu-Bin Chu[1], Chien-Wei Liao[2], Takeshi Nara[3], Ying-Chie Huang[2], Chia-Mei Chou[2], Yu-Hsin Liu[2] and Chia-Kwung Fan[2],[4],[5]

[1]. Departamento de Administração dos Cuidados com a Saúde, Disciplina de Saúde Pública e Nutrição, Universidade Médica de Taipei, Taipei, Taiwan. [2]. Departamento de Parasitologia, Universidade Médica de Taipei, Taipei, Taiwan. [3]. Departamento de Parasitologia Molecular e Celular, Universidade Juntendo de Medicina, Tóquio, Japão. [4]. Instituto de Graduação em Ciências Médicas, Faculdade Medicina, Universidade Médica de Taipei, Taipei, Taiwan. [5]. Centro de Medicina Tropical Internacional, Faculdade Medicina, Universidade Médica de Taipei, Taipei, Taiwan.

ABSTRACT

Introduction: Whether *Enterobius vermicularis* (pinworm) infections among preschool children in Taipei City had truly declined was investigated. **Methods:** A total of 6,661 preschool children from 28 nurseries were randomly selected from 4 major geographic districts in Taipei City to examine the status of pinworm infection by using adhesive thin cellophane tape swab method. **Results:** The overall prevalence of pinworm infection was 0.5% (30/6,661). Boys (0.6%; 21/3,524) had higher prevalence than girls (0.3%; 9/3,137) (p=0.06). Southern district (0.6%; 10/1,789) showed insignificantly higher prevalence than Western district (0.2%; 1/606) (p=0.22). **Conclusions:** Pinworm screening program remains necessary for some parts of Taipei City.

Keywords: *Enterobius vermicularis*. Preschool children. Taipei City.

Enterobius vermicularis (pinworm or threadworm) is the most common intestinal parasitic infection worldwide and has been present for thousands of years. Approximately 3.5 billion people are infected by intestinal parasites, and more than 400 million children are ill because of this parasitic infection. The high prevalence in children is attributed to many factors, particularly environmental and personal hygiene[1]. Embryonated eggs measure 30-60μm and are found in clothing, house dust, and other surface areas. Infection takes place through ingestion or inhalation of infective eggs or retrograde migration of hatched juveniles from the anus to the intestines, where larvae mature into adults. Gravid adult female worms migrate by night to the perianal region and deposit up to 11,000~15,000 eggs. Eggs are infective within 6h of ovideposition. Enterobiasis is usually asymptomatic or accompanied by perianal pruritus. However, there can be symptoms of restlessness, loss of appetite, insomnia, and irritability, particularly in children with high parasitic burdens. In rare instances, pinworms can cause serious gastrointestinal problems and ectopic infections in some areas, such as lung, beast, liver, and spleen. It is difficult to detect *E. vermicularis* eggs in stool because only approximately 5% eggs are to be revealed. Therefore, diagnosis of *E. vermicularis* infection is usually done using the cellophane tape method for screening instead of stool examination[2-3]. The Taipei City government, which has undertaken an annual mass pinworm screening and treatment program since 1990[4], gained excellent achievement of enterobiasis control as seen from a decreasing prevalence rate among preschool children of 4.3% in 1990 to 0.6% (27/4,349) in 2008[3]. We intended to continue monitoring the prevalence trend of pinworm infection among preschool children in kindergarten, with the aim of presenting the result to the Taipei City Government as reference to undertake further *E. vermicularis* screening program.

Taipei City may be largely divided into 4 major geographical districts (MGDs), namely, North district (including Beitou, Shillin, and Zhongshan district), South district (including Wenshan district), East district (including Xinyi, Neihu, Nangang, Songshan, and Daan districts), and West district (including Wanhua, Datong, and Zhongzheng districts). The highest average yearly family income in 2009 was 52,000 United States Dollar (USD) in the East district, followed by 50,000 USD in the North district, then 48,000 USD in the South district, and 47,000 USD in the West district according to a report by the Department of Budget, Accounting, and Statistics, Taipei City Government.

From each of the 4 MGDs, 7~8 nurseries were randomly selected for investigation on *E. vermicularis* infection by an adhesive thin cellophane tape swab method to screen the perianal region for pinworm eggs from March to June 2009. A total of 6,661 children were examined, of which 3,524 were boys and 3,137 were girls. Parents were notified of the procedure beforehand and were asked not to shower their children or have them defecate in the morning of the examination, with letters of consent sent to be signed and returned before the examinations were undertaken. Collected specimens were screened microscopically for pinworm eggs by at least 3 medical technologists. Statistical analysis was performed using SPSS (SPSS Inc., Chicago, IL, USA). Crude *odds ratios* (ORs) with their 95% confidence intervals (CIs) were estimated by means of logistic regression analysis, and correlation analysis was performed using the Pearson product-moment correlation coefficient; p values of less than 0.05 were considered to be statistically significant.

Present results indicate that the overall prevalence of pinworm infections was 0.5% (30/6,661). Boys had insignificantly higher prevalence (0.6%, 21/3,524) than girls (0.3%, 9/3,137) (OR=2.08, 95% CI=0.95-4.56, p=0.06) **(Table 1)**. According to MGDs, the highest rate was found in the South district (3.2%, 10/1789), followed by the East district (0.5%, 9/1831), the North district (0.4%, 10/2435),

Address to: Dr. Chia-Kwung Fan. Depto. Parasitologia/Instituto de Graduação de Ciências Médicas/Universidade Médica de Taipei. Wuxing Street 250, 11031 Taipei, Taiwan.
Phone/Fax: 886 2 2739-5092
e-mail: tedfan@tmu.edu.tw
Received in 03/12/2010
Accepted in 17/02/2011

and the West district (0.2%, 1/606) **(Table 1)**. Statistically, preschool children residing in the North (OR=2.50, 95% CI=0.32-19.53, p=0.37), East (OR=2.99, 95% CI=0.38-23.64, p=0.28), and South districts (OR=3.40, 95% CI=0.43-26.62, p=0.22) have higher risk of acquiring *E. vermicularis* infection than those in the West district **(Table 1)**. Interestingly, the correlation analysis showed that the prevalence significantly increased with the average yearly family income by district (r=0.64, p<0.001).

TABLE 1 - Prevalence and crude *odds ratios* with 95% confidence intervals for *Enterobius vermicularis* infection among preschool children in nurseries in Taipei City in 2009.

	Examined	Positive				
Subjects	**n**	**n**	**%**	**ORs**	**95% CI**	**p value**
Gender						
girls	3,137	9	0.3	referent		
boys	3,524	21	0.6	2.08	0.95-4.56	0.06
Geographic district						
West district	606	1	0.2	referent		
North district	2,435	10	0.4	2.50	0.32-19.53	0.37
East district	1,831	9	0.5	2.99	0.38-23.64	0.28
South district	1,789	10	0.6	3.40	0.43-26.62	0.22
Total	**6,661**	**30**	**0.5**	-	-	-

ORs: *odds ratio;* **95% CI:** 95% confidence interval; **n:** number; **%:** percentage.

Compared with those in other countries, the present prevalence was much lower than that reported in the State of Minas Gerais (8.8%, 14/160) in Brazil[5], Ankara province (10.6%, 22/207) in Turkey[6], Tartu City (31.5%, 190/604) in Korea[7], and also in southeastern Estonia (24.4%, 233/954)[8]. The present result indicates that boys had higher pinworm infection prevalence than girls, and this finding was previously reported worldwide[6-8]. Preschool children have contact with each other more frequently in nurseries and also expose themselves to unsatisfactory sanitary environments. Inadequate personal hygiene can also increase the risk of *E. vermicularis* infection among preschool children, particularly boys. Other factors, including playing on the floor, nail biting, failure to wash hands before meals, and living in nonapartment dwellings, were also reported to be associated with the prevalence of enterobiasis[1].

Although Jang et al. indicated that families with a low economic status have a higher association with *E. vermicularis* infection among preschool children in Taipei City[9], our present study indicates the opposite results. It may be alternatively explained by the fact that parents with high economic status might still overlook the importance of personal hygiene of children, thus resulting in a higher prevalence of *E. vermicularis* infection in the North and East districts. Although the symptoms of infection often are mild, the itchiness and restlessness that children experience from the infections can be discomforting and affect their learning, and the shame of having *worms* can have a negative impact on their mental health. In rare cases, enterobiasis has led to serious consequences such as acute or chronic appendicitis, eosinophilic colitis, intestinal obstruction, intestinal perforation, leukocytosis, bandemia, carcinoma, Crohn's disease, salpingitis, weight loss, urinary tract infection, and ectopic infections[2]. In addition, *E. vermicularis* might act as the vector of *Dientamoeba fragilis*, a frequently seen but rarely diagnosed protozoon as a neglected cause of diarrhea[10]. Nevertheless, enterobiasis control in Taipei City has gained excellent achievement that may be attributed not only to the infected children and family members who take medication simultaneously but also to some preventive measures like exposing clothes to sunlight, as this could help block pinworm transmission.

In conclusion, although Taipei City Government has performed a long-term pinworm screening and treatment program and gained excellent control outcome as seen from 1990 to 2009, we still urge the city government to continue its annual screening program until complete eradication of the parasite is achieved. This is important not only because of the short life cycle of *E. vermicularis* that is easy to control but also because of the need to become aware of its threat to the health of preschool children in some parts of Taipei City.

ACKNOWLEDGMENTS

We thank the Department of Health, Taipei City Government, for supporting this investigation and all the participating nurseries as well.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABSTRACT IN PORTUGUESE

A infecção *Enterobius vermicularis* está bem controlada entre as crianças das pré-escolas dos berçários da Cidade de Taipei, Taiwan

Introdução: Foi investigado se haviam realmente diminuído ou não as infecções *Enterobius vermicularis* (oxiúros) entre pré-escolares dos bercários da Cidade de Taipei, Taiwan. **Métodos:** Foram seleccionadas aleatoriamente 6.661 crianças das pré-escolas dos 28 berçários dos principais distritos na Cidade de Taipei para examinar o estado da infecção oxiuríases por meio do uso do método de fita adesiva (transparente) com mecha de algodão. **Resultados:** A prevalência global da infecção oxiúros foi de 0,5% (30-6.661). A dos meninos (0,6%, 21/3.524) foi ainda maior do que das meninas (0,3%, 9/3.137) (p = 0,06), sem significancia estatistica. O distrito do sul (0,6%, 10/1.789) mostrou- prevalência mais alta do que o distrito da parte ocidental (0,2%, 1/606) (p = 0,22), sem significância estatistica. **Conclusões:** O programa de triagem de oxiúros continua a ser necessário em algumas partes da Cidade de Taipei.

Palavras-chaves: *Enterobius vermicularis*. Crianças das pré-escolas. Cidade de Taipei.

REFERENCES

1. Warunee N, Choomanee L, Sataporn P, Rapeeporn Y, Nuttapong W, Sompong S, et al. Intestinal parasitic infections among school children in Thailand. Trop Biomed 2007; 24:83-88.
2. Kucik CJ, Martin GL, Sortor BV. Common intestinal parasites. Am Fam Physician 2004; 69:1161-1168.
3. Chang TK, Liao CW, Huang YC, Chang CC, Chou CM, Tsay HC, et al. Prevalence of *Enterobius vermicularis* infection among preschool children in kindergartens of Taipei City, Taiwan in 2008. Korean J Parasitol 2009; 47:185-187.
4. Fan PC. Review of enterobiasis in Taiwan and offshore islands. J Microbiol Immunol Infect 1998; 31:203-210.
5. Machado ER, Santos DS, Costa-Cruz JM. Enteroparasites and commensals among children in four peripheral districts of Uberlândia, State of Minas Gerais. Rev Soc Bras Med Trop 2008; 41:581-585.

6. Hazir C, Gundesli H, Ozkirim A, Keskin N. Distribution of *Enterobius vermicularis* among the schoolchildren of two primary schools with different social-economic status in the Ankara province. Turkiye Parazitol Derg 2009; 33:54-58.

7. Remm M, Remm K. Effectiveness of repeated examination to diagnose enterobiasis in nursery school groups. Korean J Parasitol 2009; 47:235-241.

8. Remm M. Distribution of enterobiasis among nursery school children in SE Estonia and of other helminthiases in Estonia. Parasitol Res 2006; 99:729-736.

9. Jang MH, Hsu HJ, Lo HM, Hsu CS, Chen RC, Chiu AW. Prevalence of *Enterobius vermicularis* infection among children attending preschools in Taipei City. Taipei City Med J 2007; 4:565-572.

10. Girginkardesler N, Kurt O, Kilimcioglu AA, Ok UZ. Transmission of *Dientamoeba fragilis*: evaluation of the role of *Enterobius vermicularis*. Parasitol Int 2008; 57:72-75.