QUANTITATIVE MICROBIOLOGICAL RISK ASSESSMENT FOR *CRYPTOSPORIDIUM* AND *GIARDIA* IN WATER, SOIL, AIR AND FOOD IN A NATIVE COMMUNITY IN MÉXICO

Ana Paola Balderrama-Carmona[1], Pablo Gortáres-Moroyoqui[1], Luis H. Alvarez-Valencia[1] and Cristóbal Cháidez-Quiroz[2]; [1]Departmento de Biotecnología y Ciencias Alimentarias, ITSON. Cd. Obregón, 85000. [2]Departmento de Seguridad Alimentaria, CIAD. payologi@msn.com

Key words: microbial risk, cryptosporidiosis, giardiasis

Introduction. *Cryptosporidium* oocysts and *Giardia* cysts are ubiquitous parasites in the environment, especially in those places where health services are inaccessible (1). USEPA guidelines have proposed a risk of $1E^{-4}$ per year (2). Nevertheless, in the case of México, there are not guidelines related to *Cryptosporidium* and *Giardia* for the determination of water quality for human consumption, which represents a serious risk to public health (3). In addition, there are no guideless to evaluate the presence or risk of these parasites in samples of food, air, and soil. Quantitative microbial risk assessment (QMRA) has data useful for creating environmental quality guidelines (2). The goal of this study was to assess the human health risks of infection by *Cryptosporidium* and *Giardia* (oo)cysts due to the exposition of people to water, soil, air, and vegetables in Potam Sonora, Mexico.

Methods. Environmental samples of water, soil, air, and vegetables were collected during 18 months (from September 2009 through March 2011) in Potam, Sonora, Mexico. *Cryptosporidium* and *Giardia* (oo)cyst concentrations were identified by fluorescent antibody procedure (4). The exponential dose-response model (5) was selected in order to determine the probability of infection. The factors that were considered to address the probability of exposure were: the (oo)cyst concentration in the sources, the amount of the product ingested, and the consumer´s exposure frequency.

Results. Dairy and annual risks related to the geometric mean concentrations in every environmental sample are shown in table 1. The well of water in Potam is unhealthy for human consumption, which implies that the well was probably contaminated by fecal microorganisms. High risks of cryptosporidiosis and giardiasis were detected from samples of soil, especially in children. Moreover the (oo)cyst concentration in air dust is not related with the concentration of total suspended particles detected. On the hand, the annual risk values (1 of 1) obtained from vegetables (serrano peppers and tomatoes) can be attributable to the traditional practice of washing them; consisting in immersing the product in water during five minutes (the water is from the same well considered in this study). The total daily risks are $9.9E^{-1}$ and $9.6E^{-1}$ for *Cryptosporidium* and *Giardia,* respectively; the total annual risk for both infections is 1, considering the simultaneous consumption of water, soil, air, and raw food

Table 1. Dairy and yearly risks about geometric mean concentration for Cryptosporidium parvum and Giardia intestinalis in well water, soil, dust, chili and tomato.

Dairy and yearly risks under given geometric mean				
	Cryptosporidium		***Giardia***	
	D	**Y**	**D**	**Y**
Water	1.5 E-1	1	4.3 E-2	9.9E-1
Soil	5.9 E-4	1.9 E-1	2.0 E-3	5.3E-1
Air dust	8.9 E-2	1	3.1 E-3	1
Chili	9.9 E-1	1*	8.2 E-1	1*
Tomato	9.9 E-1	1*	6.7 E-1	1*

D= dairy risk; Y= yearly risk. *180 days of exposure. Exponential model: *Cryptosporidium*, r=0.0199; *Giardia*, r=0.00419 (3).

Conclusion. The concentrations of (oo)cysts in the environmental samples produced high risks (1 of 1) compared with guidelines in other countries (one infection for 10000 individuals) but this research adds risks in all sampled sources. The results from the present study represent useful information that could be used to generate different programs to mitigate parasites contamination and consequently the risk of infection.

Acknowledgements. Ana Paola Balderrama acknowledges CONACYT for the scholarship provided to support the doctoral studies (Grant-230209).

References.

1. Sulaiman I, Cama V. (2006).The biology of parasites. In*: Foodborne parasites*. Ortega Y. Editorial Board, US. 15-32.
2. Rose J, Haas C, Regli S. (1991).*Am J Pub Health.* 81:709-713
3. Cháidez C, Soto M, Gortáres P, Mena K. (2005). *Int J Environ Health R.* 15:339–345.
4. Environmental Protection Agency. (1995). *ICR Protozoan method for detecting Giardia cyst and Cryptosporidium oocyst in Water by a Fluorescent Antibody Procedure.* EPA/814-B-95/003. USEPA. Ofce. Of Ground Water and Drinking Water, Washington, DC.
5. Haas C, Rose J, Gerba C. (1999).Quantitative microbial risk assessment.1st Ed. John Wiley & Sons, Inc., New York. 449 pp.