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Assessing the infection risk of enteropathogens from consumption of raw vegetables washed with contaminated water in Kathmandu Valley, Nepal

Shrestha S^{1,2}, Haramoto E¹ and Shindo J¹

¹University of Yamanashi, Japan

²Nepal Development Research Institute, Nepal

Farmers and consumers in Kathmandu Valley, Nepal commonly use well, piped, river, and/or tanker water for irrigation and washing vegetables. As these sources are contaminated with enteropathogens, consuming raw vegetables washed with this water can be a common route of exposure to pathogens. Here, the annual risk of enteropathogenic *Escherichia coli* (EPEC), *Giardia*, and *Cryptosporidium* infection (diarrhea) from the consumption of raw spinach, cabbage, carrots, and tomatoes was quantified using the probabilistic Quantitative Microbial Risk Assessment approach, which considered 12 different vegetable washing combinations. A new model was used to estimate dose of pathogens per exposure comprising parameters such as pathogen concentration in vegetable wash water before selling and eating, vegetable consumption rate, remaining pathogen ratio after washing, remaining water on vegetables after washing, and water treatment removal efficiency. When all washing

combinations were considered, high infection risks above the acceptable level of $-4 \log_{10}$ infection person⁻¹ year⁻¹ were obtained, whereas the risk was reduced when other sources excluding river water were used. Assuming use of water treated with ceramic filters by all consumers, a 0–2 \log_{10} reduction in the estimated risks was obtained, which was insufficient to achieve the required risk level. For each washing combination and enteropathogen, the median infection risk from spinach consumption was the highest, followed by that from cabbage, carrot, and tomato consumption. Infection risks from *Giardia* were higher than those from EPEC and *Cryptosporidium*. Strategies for protecting these vegetable washing water sources and advanced treatment methods to treat vegetable washing water in the valley should be established to achieve the required level of public health risk.

shankarshresthabandipur@gmail.com