Hepatitis E Virus infection and waste pickers: a case-control seroprevalence study

Short title: Hepatitis E virus and waste pickers.

Cosme Alvarado-Esquivel,^{1*} Verónica Dayali Gutierrez-Martinez,² Eda Guadalupe Ramírez-Valles,² Antonio Sifuentes-Alvarez.¹

¹Biomedical Research Laboratory. Faculty of Medicine and Nutrition, Juárez University of Durango State, Durango, Mexico.

²Faculty of Chemical Sciences, Juárez University of Durango State. Avenida Universidad S/N. 34000 Durango, Dgo, Mexico.

*Corresponding author.

Dr. Cosme Alvarado-Esquivel. Biomedical Research Laboratory. Faculty of Medicine and Nutrition. Av. Universidad S/N. 34000 Durango, Dgo. Mexico. Tel/Fax: +52-618-8130527. E-mail: alvaradocosme@yahoo.com

21 **E-mail addresses:**

22

23 CAE: alvaradocosme@yahoo.com

24 VDGM: dayali@gmail.com

25 EGRV: edagramirez@yahoo.com

26 ASA: sifual55@hotmail.com

27

28

29

30

Abstract

Whether waste pickers are a risk group for hepatitis E virus (HEV) infection is largely unknown. Therefore, this study aimed to determine the association between HEV exposure and: 1) the occupation of waste picker; and 2) the work characteristics of waste pickers. An age-and gender-matched case-control seroprevalence study of 86 waste pickers (mean age: 35.45 ± 17.15 years) and 86 control subjects of the general population was performed. We determined anti-HEV IgG antibodies in sera of cases and controls using a commercially available enzyme-linked immunoassay. The McNemar's test was used to assess the association between HEV seropositivity and the occupation of waste picker. The association between HEV seropositivity and work characteristics of waste pickers was assessed by bivariate and regression analyses. Anti-HEV IgG antibodies were detected in 14 (16.3%) of the 86 waste pickers and in 8 (9.3%) of the 86 control subjects (McNemar's pair test: OR = 13.0; 95% CI: 0.73-230.77; $P=0.02$). Ill waste pickers had a higher HEV seroprevalence than those who were apparently healthy (6/15: 40% vs 8/71: 11.3%, respectively; $P=0.01$). Waste pickers with reflexes impairment had a higher HEV seroprevalence than those without this impairment (5/10: 50% and 9/76: 11.8%, respectively; $P=0.009$). Logistic regression analysis of sociodemographic, work, and behavioral characteristics of waste pickers showed that HEV seropositivity was associated with increasing age (OR = 6.52; 95% CI: 1.95-21.78; $P=0.002$) and raising pigs (OR = 12.01; 95% CI: 1.48-97.26; $P=0.02$). This is the first age- and gender-matched case-control study on the association between HEV infection and the occupation of waste picker. Waste pickers represent a risk group for HEV infection. Factors associated with HEV

54 seropositivity found in this study may help in the design of optimal planning to avoid HEV
55 infection.

56

57

58 **Key words:** Hepatitis E virus; waste pickers; epidemiology; case-control study; Mexico.

Introduction

Estimates indicate that there are about 20 million cases of acute hepatitis E and 56000 deaths associated with this disease in the world every year [1]. Hepatitis E results from infection with hepatitis E virus that is a single-stranded, positive sense RNA virus [2]. Predominant route of infection with HEV varies depending on the development of the country. In developing countries, HEV transmission occurs via contaminated water and food by the fecal oral route; whereas in developed countries, this infection occurs by zoonotic transmission [3]. Other transmission routes of HEV include blood transfusion [4], hemodialysis [5], and solid organ transplantation [6]. Chronic infections with HEV have been reported in immunocompromised patients, and a high seroprevalence of HEV was found in patients with autoimmune hepatitis [7]. Fulminant hepatitis E has been reported in pregnant women, patients with underlying liver disease [8], and children [9]. Hepatitis E may present as sporadic cases or outbreaks [10]. Consumption of meat from HEV-infected animals including, for instance, pigs and boars may lead to infection in humans [11].

Transmission of HEV occurs in areas where poor sanitation and weak public health infrastructure exist [12]. Waste pickers is a group of people in close contact with garbage, dirty food and liquids in their occupational setting. Sometimes, they even eat food from the garbage. We are aware of only one study on the seroepidemiology of HEV infection in waste pickers. In a cross-sectional study in Brazil, researchers found a 5.1% seroprevalence of HEV infection in waste pickers [13]. Whether waste picking occupation is a risk for HEV infection is largely unknown. Therefore, we aimed to determine the association

81 between anti-HEV IgG antibodies seropositivity and: 1) the occupation of waste picker; and
82 2) the work characteristics of waste pickers.

Materials and Methods

Study design and populations studied

Through a case-control study design waste pickers (cases) and age- and gender matched control subjects without waste picker occupation (controls) were studied. Inclusion criteria for enrollment of waste pickers were: 1) subjects with an occupation of waste picker in Durango City, Mexico; 2) 14 years and older; and 3) who accepted to participate in the study. Gender and socioeconomic level were not restrictive criteria for enrollment of cases. Fifty-four (62.8%) of the waste pickers were females and 32 (37.2%) were males. Cases were 14 to 76 (mean: 35.45 ± 17.15) years old. On the other hand, inclusion criteria for enrollment of control subjects included: 1) individuals without waste picker occupation of the general population from Durango City; 2) 14 years and older; and 3) who accepted to participate in the study. The control group included 54 (62.8%) females and 32 (37.2%) males. Controls were 16 to 78 (mean: 36.05 ± 17.02) years old. Gender and age were comparable in cases and controls ($P=1.00$ and $P=0.81$, respectively).

Characteristics of waste pickers

We obtained the socio-demographic, clinical, work, housing and behavioral characteristics of waste pickers with the aid of a questionnaire. Sociodemographic items included gender, age, birthplace, residence, education, and socioeconomic level. Clinical items included the self-reported health status (ill or healthy), history of blood transfusion, and impairments in memory, reflexes, hearing and vision. Work characteristics included seniority, history of injuries with sharp material, wearing hand gloves and face masks,

eating or drinking alcohol while working, and eating from the garbage. In addition, a habitual washing hands before eating was recorded. With respect to behavioral data, the characteristics drinking untreated water or unpasteurized milk, consumption of unwashed raw vegetables or fruits, consumption of raw or undercooked meat, type of meat consumed (pork, boar, rabbit, beef, goat, lamb, venison, squirrel, horse, rat, chicken, turkey, and fish), consumption of sausages, ham, salami or chorizo, contact with animals, traveling, and contact with soil (gardening or agriculture). As to housing characteristics, we used the Bronfman's criteria [14]: number of rooms in the house, number of persons in the house, availability of drinkable water, form of elimination of excreta, and type of flooring (ceramic, wood, concrete, soil).

Detection of anti-HEV IgG antibodies

We obtained a blood sample from each subject. Serum was obtained from the blood sample by centrifugation. Serum samples were frozen at -20°C until analyzed. Detection of anti-HEV IgG antibodies in serum samples was performed by using a commercially available enzyme immunoassay kit: "AccuDiag™ HEV IgG ELISA" (Diagnostic Automation Inc., Woodland Hills, CA. USA). All assays were performed following the manufacturer's instructions.

Statistical Analysis

The statistical analysis was performed with the software Microsoft Excel, Epi Info version 7, and SPSS version 20. For the sample size calculation, we used the following parameters: a 95% two-sided confidence level, a 1:1 ratio of cases and controls, a power of

80%, a 36.6% outcome in unexposed group [15], and an odds ratio (OR) of 2.4. The result of the sample size calculation was 84 cases and 84 controls. Age in cases and controls was compared using the student's *t* test. HEV IgG seropositivity rates in cases and controls were compared using the McNemar's paired test. We used the Pearson's chi-squared test or the two-tailed Fisher's exact test (for values <5) to assess the association between the HEV IgG seropositivity rate and the characteristics of waste pickers. Then, socio-demographic, work, housing, and behavioral characteristics of waste pickers with a *P* value < 0.05 obtained in the bivariate analysis were selected for further analysis using regression analysis with the Enter method. We calculated the odds ratio (OR) and 95% confidence interval (CI), and a *P* value < 0.05 was considered as statistically significant.

Ethical aspects

The Ethical Committee of the Faculty of Medicine and Nutrition of the Juárez University of Durango State in Durango City, Mexico approved this study. Participants were informed about the aims, and procedures of the study. Participation in the study was voluntary, and a written informed consent was obtained from all subjects and the next of kin of minor participants.

Results

Anti-HEV IgG antibodies were detected in 14 (16.3%) of the 86 waste pickers and in 8 (9.3%) of the 86 control subjects. The difference between the HEV seroprevalences in cases and controls was statistically significant according to the McNemar's pair test (OR = 13.0; 95% CI: 0.73-230.77; $P=0.02$) (Table 1). As to the correlation of socio-demographic characteristics of waste pickers and HEV seropositivity, bivariate analysis showed that HEV seroprevalence increased with age ($P<0.001$). Other sociodemographic characteristics of waste pickers including gender, residence, socioeconomic status or educational level did not show an association with HEV seroprevalence. A correlation between HEV seropositivity and sociodemographic characteristics of waste pickers is shown in Table 2. Concerning clinical characteristics, waste pickers who referred themselves as ill had a higher HEV seroprevalence than those who were apparently healthy (6/15: 40% vs 8/71: 11.3%, respectively; $P=0.01$). HEV seroprevalence was comparable ($P=0.63$) in waste pickers with a history of blood transfusion (2/9: 22.2%) than in those without blood transfusion (12/77: 15.6%). Waste pickers with reflexes impairment had a higher HEV seroprevalence than those without this impairment (5/10: 50% and 9/76: 11.8%, respectively; $P=0.009$). Impairments in memory, hearing and vision did not show an association with HEV seropositivity. Of the work characteristics, HEV seroprevalence increased with seniority (Table 3), whereas other work characteristics including history of injuries with sharp material, wearing hand gloves and face masks, eating or drinking alcohol while working, washing hands before eating, and eating from the garbage did not show an association with HEV seropositivity. As to behavioral characteristics of waste

pickers, bivariate analysis showed that raising pigs, consumption of venison, and squirrel meat were associated ($P<0.05$) with HEV seropositivity (Table 4). Other behavioral characteristics of waste pickers including consumption of untreated water, unpasteurized milk, unwashed raw vegetables or fruits, raw or undercooked meat, consumption of meat other than venison or squirrel meat, consumption of sausages, ham, salami or chorizo, contact with animals other than pigs, traveling and contact with soil did not show an association with HEV seropositivity. None of the housing characteristics of waste pickers including number of rooms in the house, number of persons in the house, availability of drinkable water, form of elimination of excreta, and type of flooring were associated with HEV seropositivity. Further analysis by logistic regression of sociodemographic, work, and behavioral characteristics of waste pickers with a $P<0.05$ obtained in bivariate analysis showed that HEV seropositivity was associated with increasing age (OR = 6.52; 95% CI: 1.95-21.78; $P=0.002$) and raising pigs (OR = 12.01; 95% CI: 1.48-97.26; $P=0.02$) (Table 5).

Discussion

The seroepidemiology of HEV infection in waste pickers has been poorly studied. There has been only one previous study on the seroprevalence of HEV in waste pickers. In such study researchers reported the seroprevalence of HEV infection in waste pickers in a central Brazilian city [13]. The design of their study was cross-sectional, and the association between waste picker occupation and HEV seroprevalence was not determined. Therefore, in the present study, using an age and gender-matched case-control design, we aimed to determine the association between HEV seropositivity and the occupation of waste picker. Using the McNemar's pair test, we found that waste pickers had a significantly higher HEV seroprevalence than controls. Thus, this result suggests that waste picker occupation is associated with HEV infection. The HEV seroprevalence of waste pickers was also associated with seniority in the activity by bivariate analysis. This result further supports the association between HEV seropositivity and waste picker occupation. The fecal oral route of HEV infection has been described as predominant in developing countries [3]. Garbage handled by waste pickers might be contaminated with HEV since fecal material is present in the city garbage. We further searched for sociodemographic, work, housing, and behavioral factors associated with HEV seroprevalence. Logistic regression analysis showed that only the variables increasing age and pig raising were associated with HEV seropositivity. Concerning the variable increasing age, our result agrees with previous observations that this factor is associated with HEV seropositivity in population groups in Mexico [15-17], and other countries [18-20]. With respect to the variable pig raising, our result is in line with previous observation about the link between

HEV infection in humans and contact with pigs. In a meta-analysis of 32 studies from 16 countries, researchers found an increased seroprevalence of HEV infection in swine workers [21]. In another meta-analysis in China, researchers concluded that contact with pork or other pig products may be an important mode of HEV transmission [22]. In addition, a high seroprevalence of HEV infection in pigs in Durango, Mexico has been reported [23].

Intriguingly, ill waste pickers had a higher HEV seroprevalence than apparently healthy waste pickers. Similarly, waste pickers with reflexes impairment had a higher HEV seroprevalence than those without this impairment. We are not aware of a report about the link between HEV seropositivity and reflexes impairment. Acute and chronic HEV infections may lead to extrahepatic manifestations and has been associated with neurological diseases [24, 25], including for instance, neuralgic amyotrophy [26], acute encephalitis Parkinsonism [25], and Guillain Barré syndrome [27].

The limitations of the study include that no further testing for HEV infection as detection of IgM antibodies by enzyme immunoassay or DNA by polymerase chain reaction was performed; and participants were enrolled only in Durango City. Further research to determine the seroepidemiology of HEV infection in waste pickers should be conducted.

Conclusions

This is the first age- and gender matched case-control study on the association between HEV infection and the occupation of waste picker. Waste pickers represent a risk

243 group for HEV infection. Factors associated with HEV seropositivity found in this study
244 may help in the design of optimal planning to avoid HEV infection.

245

246

247

References

1. Blasco-Perrin H, Abravanel F, Blasco-Baque V, Péron JM. Hepatitis E, the neglected one. *Liver Int.* 2016 Jan;36 Suppl 1:130-4. doi: 10.1111/liv.13014.
2. Kelly AG, Netzler NE, White PA. Ancient recombination events and the origins of hepatitis E virus. *BMC Evol Biol.* 2016 Oct 12;16(1):210.
3. Himmelsbach K, Bender D, Hildt E. Life cycle and morphogenesis of the hepatitis E virus. *Emerg Microbes Infect.* 2018 Nov 29;7(1):196. doi: 10.1038/s41426-018-0198-7.
4. Kamar N, Izopet J, Pavio N, Aggarwal R, Labrique A, Wedemeyer H, Dalton HR. Hepatitis E virus infection. *Nat Rev Dis Primers.* 2017 Nov 16;3:17086. doi: 10.1038/nrdp.2017.86.
5. Haffar S, Bazerbachi F, Leise MD, Dillon JJ, Albright RC, Murad MH, Kamath PS, Watt KD. Systematic review with meta-analysis: the association between hepatitis E seroprevalence and haemodialysis. *Aliment Pharmacol Ther.* 2017 Nov;46(9):790-799. doi: 10.1111/apt.14285.
6. Fang SY, Han H. Hepatitis E viral infection in solid organ transplant patients. *Curr Opin Organ Transplant.* 2017 Aug;22(4):351-355. doi: 10.1097/MOT.0000000000000432.

271 7. Eder M, Strassl R, Beinhardt S, Stättermayer AF, Kozbial K, Lagler H, Holzmann H,
272 Trauner M, Hofer H. High Seroprevalence of anti-Hepatitis E antibodies in Austrian
273 patients with Autoimmune Hepatitis. *Liver Int.* 2018 Nov 15. doi: 10.1111/liv.14005.
274

275 8. Izopet J, Lhomme S, Chapuy-Regaud S, Mansuy JM, Kamar N, Abravanel F. HEV and
276 transfusion-recipient risk. *Transfus Clin Biol.* 2017 Sep;24(3):176-181. doi:
277 10.1016/j.tracli.2017.06.012.
278

279 9. Tolani D, Shah I. Fulminant hepatitis E in an infant. *J Family Med Prim Care.* 2017 Jul-
280 Sep;6(3):649-650. doi: 10.4103/2249-4863.222008.
281

282 10. Gupta E, Agarwala P. Hepatitis E virus infection: An old virus with a new story! *Indian*
283 *J Med Microbiol.* 2018 Jul-Sep;36(3):317-323. doi: 10.4103/ijmm.IJMM_18_149.
284

285 11. De Sabato L, Ostanello F, De Grossi L, Marcario A, Franzetti B, Monini M, Di Bartolo
286 I. Molecular survey of HEV infection in wild boar population in Italy. *Transbound Emerg*
287 *Dis.* 2018 Dec;65(6):1749-1756. doi: 10.1111/tbed.12948.
288

289 12. De Schryver A, De Schrijver K, François G, Hambach R, van Sprundel M, Tabibi R,
290 Colosio C. Hepatitis E virus infection: an emerging occupational risk? *Occup Med (Lond).*
291 2015 Nov;65(8):667-72. doi: 10.1093/occmed/kqv154.
292

13. Martins RM, Freitas NR, Kozłowski A, Reis NR, Lopes CL, Teles SA, Gardinali NR, Pinto MA. Seroprevalence of hepatitis E antibodies in a population of recyclable waste pickers in Brazil. *J Clin Virol*. 2014 Mar;59(3):188-91. doi: 10.1016/j.jcv.2014.01.002.
14. Bronfman M, Guiscafré H, Castro V, Castro R, Gutiérrez G. La medición de la desigualdad: una estrategia metodológica, análisis de las características socioeconómicas de la muestra. *Arch Invest Med*. 1988;19:351-360.
15. Alvarado-Esquivel C, Sanchez-Anguiano LF, Hernandez-Tinoco J. Seroepidemiology of hepatitis e virus infection in general population in rural durango, Mexico. *Hepat Mon*. 2014 Jun 1;14(6):e16876. doi: 10.5812/hepatmon.16876.
16. Alvarado-Esquivel C, Sanchez-Anguiano LF, Hernandez-Tinoco J. Seroepidemiology of hepatitis e virus infection in mennonites in Mexico. *J Clin Med Res*. 2015 Feb;7(2):103-8. doi: 10.14740/jocmr1993w.
17. Alvarado-Esquivel C, Sánchez-Anguiano LF, Hernández-Tinoco J. Hepatitis E virus exposure in pregnant women in rural Durango, Mexico. *Ann Hepatol*. 2014 Sep-Oct;13(5):510-7.
18. Olsøy IB, Henriksen S, Weissbach FH, Larsen M, Borgen K, Abravanel F, Kamar N, Paulssen EJ, Hirsch HH, Rinaldo CH. Seroprevalence of hepatitis E virus (HEV) in a

general adult population in Northern Norway: the Tromsø study. *Med Microbiol Immunol*.
2019 Mar 22. doi: 10.1007/s00430-019-00599-5.

19. Hewitt J, Harte D, Sutherland M, Croucher D, Fouche L, Flanagan P, Williamson D.
Prevalence of hepatitis E virus antibodies and infection in New Zealand blood donors. *N Z
Med J*. 2018 Feb 2;131(1469):38-43.

20. Dimeglio C, Beau F, Broult J, Gouy P, Izopet J, Lastère S, Abravanel F. Hepatitis E
prevalence in French Polynesian blood donors. *PLoS One*. 2018 Dec 7;13(12):e0208934.
doi: 10.1371/journal.pone.0208934.

21. Huang X, Huang Y, Wagner AL, Chen X, Lu Y. Hepatitis E virus infection in swine
workers: A meta-analysis. *Zoonoses Public Health*. 2019 Feb;66(1):155-163. doi:
10.1111/zph.12548.

22. Yue N, Wang Q, Zheng M, Wang D, Duan C, Yu X, Zhang X, Bao C, Jin H.
Prevalence of hepatitis E virus infection among people and swine in mainland China: A
systematic review and meta-analysis. *Zoonoses Public Health*. 2019 Mar 18. doi:
10.1111/zph.12555.

23. Alvarado-Esquivel C, Sánchez-Anguiano LF, Hernández-Tinoco J, Alvarado-Félix ÁO. Seroepidemiology of hepatitis E virus infection in pigs in Durango State, Mexico. *J Med Virol.* 2018 Feb;90(2):328-333. doi: 10.1002/jmv.24951.

24. Narayanan S, Abutaleb A, Sherman KE, Kottitil S. Clinical features and determinants of chronicity in hepatitis E virus infection. *J Viral Hepat.* 2019 Apr;26(4):414-421. doi: 10.1111/jvh.13059.

25. Pasha SA, Pasha SA, Suhasini T, Rao DA. Hepatitis E Virus-Associated Acute Encephalitic Parkinsonism. *J Assoc Physicians India.* 2018 Mar;66(3):92-3.

26. van Eijk JJJ, Dalton HR, Ripellino P, Madden RG, Jones C, Fritz M, Gobbi C, Melli G, Pasi E, Herrod J, Lissmann RF, Ashraf HH, Abdelrahim M, Masri OABAL, Fraga M, Benninger D, Kuntzer T, Aubert V, Sahli R, Moradpour D, Blasco-Perrin H, Attarian S, Gérolami R, Colson P, Giordani MT, Hartl J, Pischke S, Lin NX, Mclean BN, Bendall RP, Panning M, Peron JM, Kamar N, Izopet J, Jacobs BC, van Alfen N, van Engelen BGM. Clinical phenotype and outcome of hepatitis E virus-associated neuralgic amyotrophy. *Neurology.* 2017 Aug 29;89(9):909-917. doi: 10.1212/WNL.0000000000004297.

27. Belbézier A, Lagrange E, Bouillet L. [Neurologic disorders and Hepatitis E: Review of literature]. *Rev Med Interne.* 2018 Nov;39(11):842-848. doi: 10.1016/j.revmed.2018.06.008.

Table 1: Distribution of HEV infection among case control pairs.

Case	Control		Total	OR [95% CI]	P-value
	Exposed (HEV infection)	Unexposed (No HEV infection)			
Exposed (HEV infection)	8	6	14		
Unexposed (No HEV infection)	0	72	72		
Total	8	78	86	13.0 [0.73-230.77]	0.02

0.5 has been added to each cell for calculation.

Table 2. Socio-demographic characteristics of waste pickers and prevalence of HEV infection.

Characteristic	Subjects tested No.	Prevalence of HEV infection		<i>P</i> value
		No.	%	
Age groups (years)				
30 or less	46	2	4.3	<0.001
31-50	20	3	15.0	
>50	20	9	45.0	
Gender				
Male	32	4	12.5	0.46
Female	54	10	18.5	
Residence place				
Durango State	84	13	15.5	0.30
Other Mexican State	2	1	50.0	
Residence area				
Urban	79	12	15.2	0.72
Suburban	4	1	25.0	
Rural	2	0	0.0	
Socio-economic level				
Low	65	9	13.8	0.25
Medium	15	4	26.7	
Educational level				
No education	26	6	23.1	0.35
1 to 6 years	48	8	16.7	
7-12 years	11	0	0.0	
>12 years	1	0	0.0	

Table 3. Bivariate analysis of work factors and seroprevalence of HEV infection in waste pickers.

Characteristic	Subjects tested No.	Prevalence of HEV infection		<i>P</i> value
		No.	%	
Seniority				
Up to 10 years	44	3	6.8	0.03
>10 years	41	10	24.4	
Wearing gloves				
Yes	16	4	25.0	0.45
No	69	10	14.5	
Wearing face mask				
Yes	1	0	0	1.00
No	84	14	16.7	
Injuries at work				
Yes	61	10	16.4	1.00
No	23	4	17.4	
Eating during work				
Yes	48	10	20.8	0.21
No	37	4	10.8	
Eating from the garbage				
Yes	61	9	14.8	0.52
No	24	5	20.8	
Washing hands before eating				
Yes	64	11	17.2	1.00
No	21	3	14.3	
Alcohol consumption				
Yes	29	6	20.7	0.54
No	56	8	14.3	

^aParticipants with available data.

Table 4. Bivariate analysis of a selection of behavioral and housing characteristics and seropositivity to HEV in waste pickers.

Characteristic	Subjects tested No.	Prevalence of HEV infection		<i>P</i> value
		No.	%	
Raising farm animals				
Yes	35	9	25.7	0.05
No	51	5	9.8	
Pig raising				
Yes	8	5	62.5	0.002
No	78	9	11.5	
Traveled abroad				
Yes	4	2	50.0	0.12
No	81	12	14.8	
National trips				
Yes	26	6	23.1	0.34
No	59	8	13.6	
Pork meat consumption				
Yes	70	13	18.6	0.45
No	16	1	6.2	
Boar meat consumption				
Yes	4	1	25.0	0.49
No	81	12	14.8	
Venison consumption				
Yes	10	4	40.0	0.04
No	75	9	12.0	
Squirrel meat consumption				
Yes	8	4	50.0	0.01
No	77	9	11.7	
Rat meat consumption				
Yes	1	1	100.0	0.16
No	85	13	15.3	
Degree of meat cooking				
Undercooked	5	0	0.0	0.58
Well done	79	14	17.7	
Cow raw milk consumption				
Yes	24	6	25.0	0.20
No	62	8	12.9	
Goat raw milk consumption				
Yes	3	2	66.7	0.06
No	83	12	14.5	
	24			

Sheep raw milk consumption				
Yes	1	1	100.0	0.16
No	85	13	15.3	
Unwashed raw vegetables				
Yes	29	2	6.9	0.12
No	57	12	21.1	
Floor at home				
Ceramic or wood	3	2	66.7	0.05
Concrete	37	5	13.5	
Soil	46	7	15.2	
Crowding at home				
No	18	6	33.3	0.08
Semi-crowded	50	7	14.0	
Overcrowded	15	1	6.7	

380

381

382

383

Table 5. Multivariate analysis of selected characteristics of waste pickers and their association with HEV infection.

Characteristic	Odds ratio	95% confidence interval	<i>P</i> value
Increasing age	6.52	1.95-21.78	0.002
Seniority	0.45	0.12-1.73	0.24
Pig raising	12.01	1.48-97.26	0.02
Consumption of venison	0.99	0.15-6.20	0.99
Consumption of squirrel meat	3.86	0.43-33.99	0.22