Research Article

First Serological Evidence of Hepatitis E Virus Infection in Domestic Pigs Slaughtered at the Slaughterhouse of Ivorian Slaughtering and Meat Processing Company (SIVAC) in Yopougon, Abidjan, Côte d'Ivoire

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Abstract | Hepatitis E virus (HEV) infection in pigs in West Africa has been the subject of several research. However, data on the exposure of domestic pigs to HEV in modern pig farms in Côte d'Ivoire remain lacking. To address this knowledge gap, we conducted the first serological survey at the national slaughterhouse on 413 slaughtered aged pigs from 11 localities. Blood samples were collected and the plasma analysed by enzyme-linked immunosorbent assay (ELISA) using a commercial kit for the detection of total anti-HEV antibodies. The overall seroprevalence was 75.3% (311/413; 95% CI: 70.9–79.2%). Seroprevalence was recorded in all the localities and ranged from 44% to 100% with highly significant difference ($p < 0.001$). Seroprevalence of the Duroc and Landrace breeds at the locality level is not statistically significant ($p = 0.706$). In contrast, for the Large White and Piétrain breeds, there was a highly significant difference ($p < 0.001$). Statistical analysis of seroprevalence specific to each age group across the localities revealed highly significant differences ($p < 0.001$). Here we report high seroprevalence of hepatitis E among domestic pigs slaughtered at the national slaughterhouse, suggestting that HEV is present in Côte d'Ivoire. Such widespread exposure of pigs to the virus may pose a potential health risk to the slaughterhouse workers, and to farmers in these production localities. Strengthening hygiene measures particularly through the use of personal protective equipment (coats, boots, gloves) and hand washing, as well as raising awareness of hepatitis E, will be necessary to limit zoonotic transmission.

Keywords | Hepatitis E virus, Seroprevalence, Domestic pigs, Slaughterhouse, Côte d'Ivoire

Received | May 07, 2026; **Accepted** | July 13, 2026; **Published** | August 05, 2026
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Citation | Adombi CM, Aboly BN, Daramcoum WAM-P, Senin CBV, Kaba I, Djaman AJ, Quer J (2026). First serological evidence of Hepatitis E Virus infection in domestic pigs slaughtered at the slaughterhouse of ivorian slaughtering and meat processing company (SIVAC) in Yopougon, Abidjan, Côte d'Ivoire. Adv. Anim. Vet. Sci., 14(8):1731-1739.
DOI | https://dx.doi.org/10.17582/journal.aavs/2026/14.8.1731.1739
ISSN (Online) | 2307-8316

INTRODUCTION

According to the World Health Organization (WHO, 2016), viral hepatitis (A, B, C, D and E) remain a global public health and development priority. Among these five major types of human viral hepatitis, hepatitis E, still unfamiliar to the general public, is unique in having an animal reservoir and in being zoonotic, (Pavio *et al*., 2015). The pathogen known as hepatitis E virus (HEV) is classified into eight genotypes (HEV1-HEV8), recently designated as the species *Paslahepevirus balayani* (Smith *et al*., 2020). Genotypes 1 and 2 infect only humans and are transmitted through the consumption of water contaminated with human faeces. In contrast, genotypes 3 to 8 are of animal origin (Turlewicz-Podbielska *et al*., 2023). Of these genotypes, genotypes 3, 4 and 7 are recognized as zoonotic. Genotype 3 is widespread throughout the world and the less common genotype 4 are of porcine origin. They are also found in other domestic and wild animal species, whereas the other animal genotypes have not yet been reported in pigs (Turlewicz-Podbielska *et al*., 2023).

Pigs are the major reservoir of HEV (Rose *et al*., 2011). However, the virus also infects a wide range of domestic animals (rabbits, cattle, goats, sheep, camels) and wild animals (wild boars, deer, fallow deer, mongooses, rats) (Turlewicz-Podbielska *et al*., 2023; Kenney, 2019). Transmission of genotypes 3 and 4 to humans poses a public health and food safety concern. Indeed, in Europe, Asia and the Americas, genotypes 3 and 4 are responsible for sporadic cases of acute and chronic hepatitis in humans (Riveiro-Barciela *et al*., 2015; Intharasongkroh *et al*., 2017). They are transmitted mainly through the consumption of raw or undercooked pork and pork products and through close contact with infected animals (Khuroo *et al*., 2016; Wang *et al*., 2020). Infections via transfusion of contaminated blood products, consumption of contaminated shellfish and environmental contamination due to runoff from animal manure have also been reported (Khuroo *et al*., 2016; Mirazo *et al*., 2014). In West Africa, very few studies have been conducted on the genotypes circulating in pigs. Molecular analyses have confirmed the presence of genotype 3 in liver samples (Traoré *et al*., 2015; Tene *et al*., 2024), faeces (Owolodun *et al*., 2014; Doukouré *et al*., 2024) and serum (El-Duah *et al*., 2020; Suluku *et al*., 2024). However, little information is available on the routes of transmission of this genotype to humans. Serological studies have reported high seroprevalence rates in pigs, particularly in countries neighbouring Côte d'Ivoire such as Burkina Faso, Ghana and Guinea (Bagulo *et al*., 2021; Tialla *et al*., 2022; Doukouré *et al*., 2024). Unfortunately, the situation is quite different in Côte d'Ivoire. To our knowledge, there are no data available on the seroprevalence of hepatitis E in pigs although the pig industry is key to the government's plan for self-sufficiency in animal protein. According to the Ministry of Animal and Fishery Resources (MIRAH, 2022), it is a strategic sector for the food and nutritional security of the ivorian population. Indeed, pork is the second consumed meat after fish in Côte d'Ivoire. It is a very popular meat in households and in ivorian street food due to its relatively affordable price. The Food and Agriculture Organization (FAOSTAT, 2020) estimated that the volume of purchases of pork and pork products has increased by an average of 21.41% per year, rising from 55,712 tonnes in 2019 to 121,055 tonnes in 2023. The pig industry also plays a crucial role in the fight against poverty as it is a source of income and employment (Kouadio and Yao, 2020). Annually, it generates a turnover of over 70 billion CFA francs and employs more than 30,000 people, including around 1,500 professional pig farmers. Given the importance of the pig industry at national level, this first serological survey was launched at the national slaughterhouse with the aim of determining the seroprevalence of hepatitis E in slaughtered pigs from modern farms in the main production localities of Côte d'Ivoire.

MATERIALS AND METHODS

Study site

This study was conducted at the modern industrial pig slaughterhouse of the Ivorian Slaughtering and Meat Processing Company (SIVAC), located in the industrial zone of the municipality of Yopougon (5°20'N and 4°00'W) in the Autonomous District of Abidjan. The SIVAC slaughterhouse receives pigs from various localities and geographical regions of Côte d'Ivoire. It is the largest source of pork supply for the economic capital of Abidjan, with 100 to 120 pigs slaughtered per day. Authorisation to collect blood samples from pigs at the SIVAC slaughterhouse has been granted by the Director General of SIVAC (Ref. No. 131/SIVAC/DG/Nov-23).

Sampling plan

This is a cross-sectional survey conducted at the SIVAC slaughterhouse between January and February 2024. The convenience sampling method was used. Based on data from the slaughterhouse, batches of apparently healthy pigs were sampled in accordance with the processing flow of the main pig-producing localities, from a list of days and times of the slaughter. All pigs in each batch were sampled, for a total of 413 pigs (17 batches) from 15 modern pig farms across 11 localities: Akoupé-Zeudji (n = 33), Attinguié (n = 25), Azaguié (n = 14), Bingerville (n = 73), Bouaflé (n = 73), KM17 (n = 12), Kotiéssou (n = 85), Port-Bouët (n = 15), Sikensi (n = 25), Sinfra (n = 10) and Toumodi (n = 48) (Figure 1). These 11 localities accounted for 67.9% (23,993/35,314) of pigs slaughtered at SIVAC in 2023. Information available such as sex, breed, age, locality of origin and collection date was recorded.

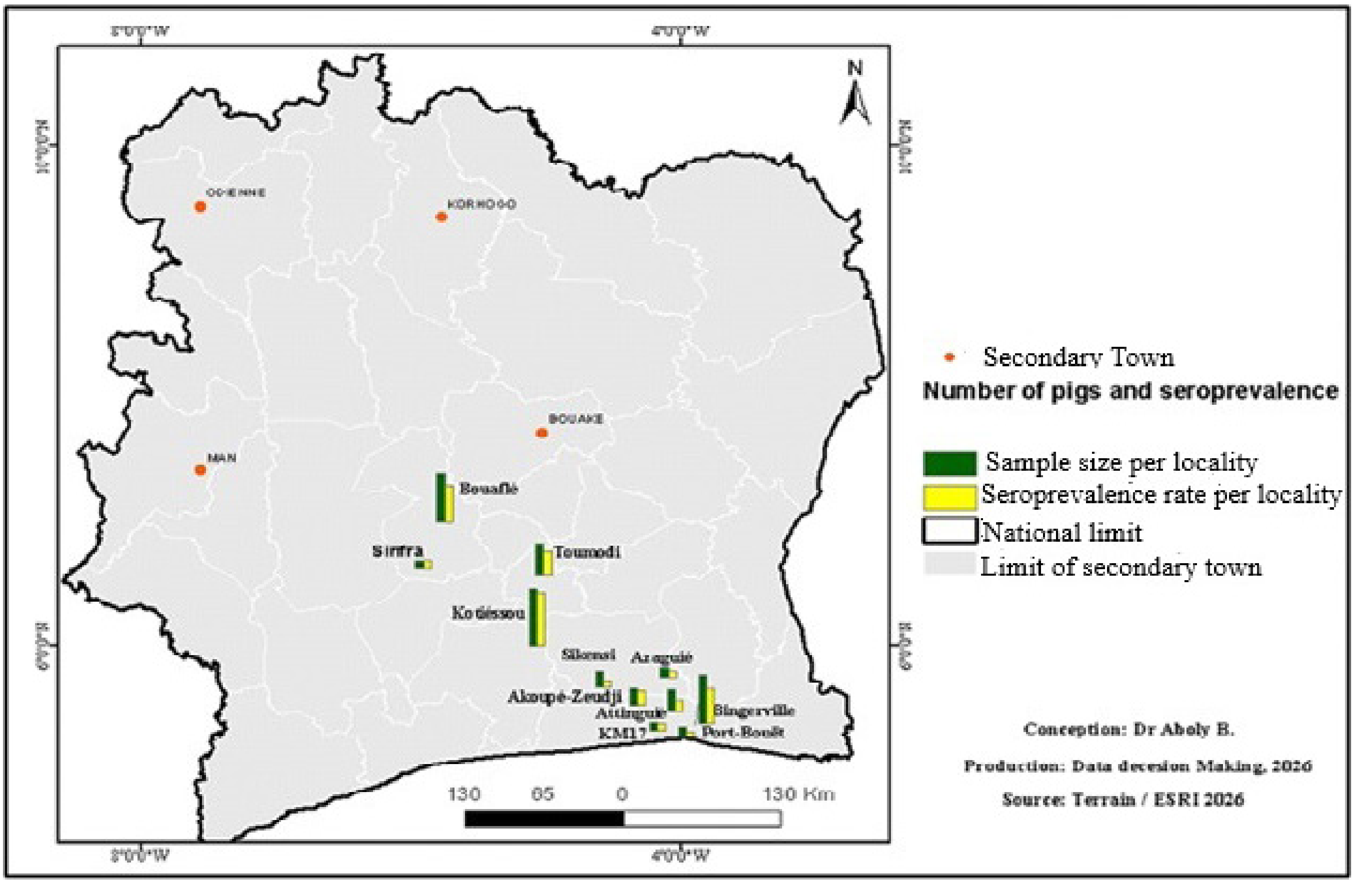

Figure 1: Map of Cote d'Ivoire showing the 11 localities of origin of slaughtered pigs tested for anti-hepatitis E virus antibodies. Green chart indicates the sample size per locality and yellow chart the corresponding seroprevalence rate.

Sample size

The sample size (N) required for this study was determined using the following formula described by Ancelle (2017).

$$N = Z^2 \times P(1-P) / D^2$$

Where; N= Expected sample size, Z= 1.96 for 95% Confidence Interval (CI), D= Margin of error set at 5%, P= Estimated prevalence of 50% for a 95% certainty and 5% precision. This resulted in a sample size of 385. However, 413 blood samples were collected and sent to the laboratory.

Sample collection

Five millilitres of blood were collected aseptically in EDTA tubes from each animal at the time of bleeding. Important information such as the location of origin, age, sex and breed of the animals was recorded for all pigs in each batch. These blood samples were transported in a cooler containing ice packs to the Viral Serology Laboratory at the Pasteur Institute of Côte d'Ivoire. They were centrifuged at 3,000 × g for 5 minutes. The plasma was aliquoted into cryotubes and stored at -20°C until serological analysis.

Serological analyses

The 413 plasma samples were analysed according to the protocol described in the 'HEV ELISA 4.0V' kit (MP Diagnostics-Biomedicals). This kit which is exclusively for veterinary use is a double sandwich ELISA test that detects total anti-HEV antibodies (IgG, IgM and IgA) directed against the hepatitis E virus in the serum or plasma of pigs and other animal species. The test uses a recombinant antigen that is highly conserved among different HEV strains (genotypes 1 to 4), but genotypes 1 and 2 don't infect pigs. This kit has already been used on sera from slaughterhouse pigs in West African countries where genotype 3 has been detected (Traoré *et al*., 2015; Setondji *et al*., 2023). Absorbance was measured at 450 nm using the Multiskan FC ELISA plate reader distributed by Thermo Scientific.

Statistical analysis

The data were processed using Excel 2016 and STATA 14.2. These two software packages were used to calculate both frequencies and prevalences. Pearson's chi-square test was applied to determine the link between seropositive pigs and intrinsic variables such as sex, breed and age, as well as place of origin. The significance threshold was set at $p < 0.05$. Confidence interval method, with a 95% confidence level was used to estimate the proportion of variables within the sampled population and to assess the reliability of the findings.

RESULTS

Descriptive analysis of pigs

The 413 pigs sampled came from 11 localities in Côte d'Ivoire. The number of pigs per locality varied, with a minimum of 10 pigs (Sinfra) and a maximum of 85 pigs (Kotiéssou). The major sites included Kotiéssou (20.6%), Bingerville and Bouaflé (17.7%, respectively) and Toumodi (11.6%) (Table 1).

Distribution by sex

The majority of pigs for slaughter were male (56.9%). They were concentrated in the localities of Attinguié (64%), Bingerville and Bouaflé (65.8%), Kotiéssou (61.2%), Port-Bouët (53.3%) and Sinfra (60%). As for females, the proportions were higher in Akoupé-Zeudji (51.5%), Azaguié (71.4%), KM17 (58.3%), Sikensi (60%) and Toumodi (54.2%). The analysis of the distribution by sex has revealed a p-value of 0.057.

Distribution by breed

The dominant breed was Large White (52.3%), followed by Landrace (23.9%), Piétrain (18.4%) and Duroc (5.3%). Some breeds were absent in several localities, notably Duroc and Landrace, which were absent from Attinguié, Bouaflé, KM17, Sikensi and Toumodi. The Large White, Piétrain and Duroc breeds were only absent in Bingerville, Sikensi and Kotiéssou. The Landrace breed was not represented in Azaguié, Port-Bouët and Sinfra. The analysis shows that breeds are specific to the locality of origin (Table 1).

Distribution by age group

The pigs were between 5 and 9 months old. They were divided into three age groups: 5-6, 6-7 and 7-9 months, with respective percentages of 16.9%, 36.1% and 47%. Some age groups were exclusive (100%) to specific localities, such as the 5-6 months age group, which was only observed in Akoupé-Zeudji, KM17, and Sikensi. The age group 6-7 months was present in Attinguié and Sinfra, while the age group 7-9 months was recorded in Azaguié and Port-Bouët. The analysis shows that there is high demand for slaughter pigs aged between 7 and 9 months (Table 1).

Prevalence of seropositive pigs

Overall prevalence

The overall seroprevalence of total anti-HEV antibodies in the pigs studied was 75.3% (311/413; 95% CI: 70.9–79.2%). All batches of pigs (17/17) had at least one animal seropositive for anti-HEV antibodies. At the batch level, seroprevalence ranged from 33.3% to 100% (Figure 2).

Locality-wise seroprevalence

Seroprevalence was recorded in all the localities from which the pigs originated. It ranged from 44% (95% CI : 26.7-62.9%) to 100% (95% CI: 72.2-100%). The localities of Sinfra (100%; 95% CI: 72.2-100%), Kotiéssou (94.1%; 95% CI: 87-97.5%]) and KM17 (91.7%; 95% CI: 64.6-98.5%) have recorded the highest prevalence rates. Analysis of seroprevalence by locality of origin revealed a highly significant difference ($p < 0.001$). Indeed, there is no overlap between the confidence intervals for several localities of origin (Table 2).

Table 1: Descriptive analysis of the 413 pigs sampled at the slaughterhouse by location according to the animals' sex, breed and age group.

	Overall	Akoupé Zeudji	Attin-guié	Azaguié	Binger-ville	Bouaflé	KM17	Kotiés-sou	Port-Bouët	Sikensi	Sinfra	Toumodi
Sampledanimals (%)												
Analysed-variables	413	33(7.9)	25(6.1)	14(3.4)	73(17.7)	73(17.68)	12(2.9)	85(20.6)	15(3.6)	25(6.1)	10(2.4)	48(11.6)
Sex												
Male	235(56.9%)	16(48.5)	16(64)	4(28.6)	48(65.8)	48(65.8)	5(41.7)	52(61.2)	8(53.3)	10(40)	6(60)	22(45.8)
Female	178(43.1)	17(51.5)	9(36)	10(71.4)	25(34.3)	25(34.2)	7(58.3)	33(38.8)	7(46.7)	15(60)	4(40)	26(54.2)
Breed												
Duroc	22(5.3)	4(12.1)	0(0)	1(7.1)	13(17.8)	0(0)	0(0)	0(0)	3(20)	0(0)	1(10)	0(0)
Landrace	99(23.9)	1(3)	0(0)	0(0)	35(47.9)	0(0)	0(0)	63(74.1)	0(0)	0(0)	0(0)	0(0)
Large-White	216(52.3)	25(75.8)	20(80)	9(64.3)	0(0)	59(80.8)	11(91.7)	7(8.2)	11(3.3)	25(100)	7(70)	42(87.5)
Piétrain	76(18.4)	3(9.1)	5(20)	4(28.6)	25(34.3)	14(19.2)	1(8.3)	15(17.7)	1(6.7)	0(0)	2(20)	6(12.5)
Agegroup (month)												
5-6	70(16.9)	33(100)	0(0)	0(0)	0(0.0)	0(0)	12(100)	0(0)	0(0)	25(100)	0(0)	0(0)
6-7	149(36.1)	0(0)	25(100)	0(0)	25(34.3)	39(53.4)	0(0)	40(47.1)	0(0)	0(0)	10(100)	10(20.8)
7-9	194(47)	0(0)	0(0)	14(100)	48(65.7)	34(46.6)	0(0)	45(52.9)	15(100)	0(0)	0(0)	38(79.2)

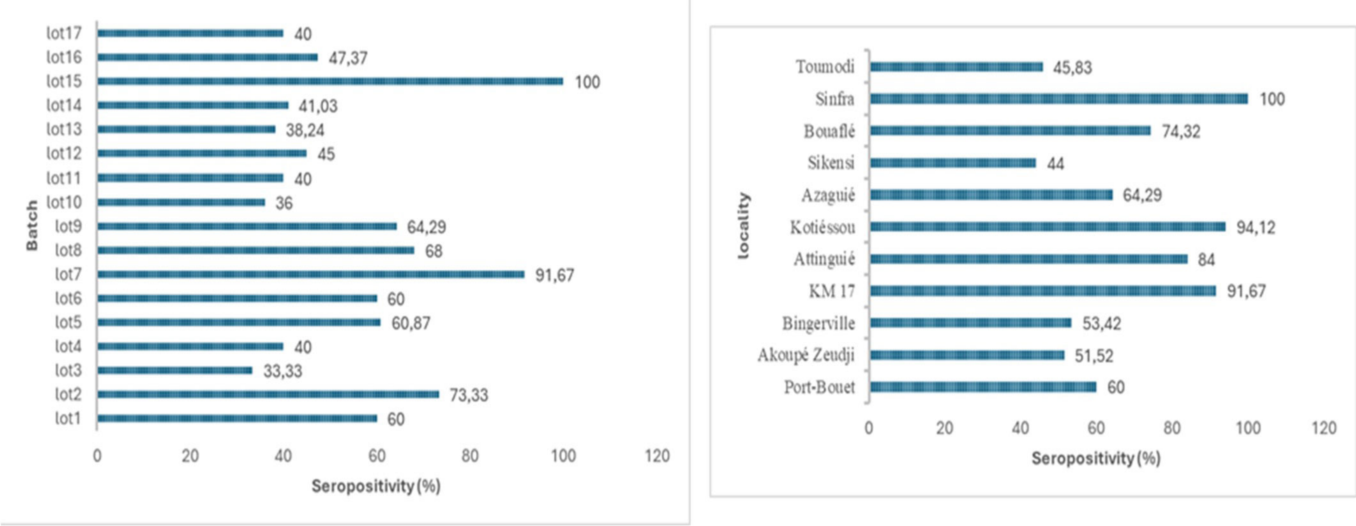

Figure 2: Seroprevalence rate (%) of hepatitis E by batch of pigs and by location.

Table 2: Locality distribution of total anti-HEV antibodies in pigs slaughtered at the SIVAC abattoir.

Locality	No. tested	No. negative (%)	No. positive (%)	95% CI	p-value
Akoupé-Zeudji	33	16 (48.5%)	17 (51.5%)	35.2-67.5	
Attinguié	25	4 (16%)	21 (84%)	65.3-93.6	
Azaguié	14	5 (35.7%)	9 (64.3%)	38.8-83.7	
Bingerville	73	21 (28.8%)	52 (71.2%)	60.0-80.3	
Bouaflé	73	18 (24.7%)	55 (75.3%)	64.4-83.8	
KM17	12	1 (8.3%)	11 (91.7%)	64.6-98.5	
Kotiéssou	85	5 (5.9%)	80 (94.1%)	87.0-97.5	
Port-Bouët	15	6 (40%)	9 (60%)	35.7-80.2	
Sikensi	25	14 (56%)	11 (44%)	26.7-62.9	
Sinfra	10	0 (0%)	10 (100%)	72.2-100	
Toumodi	48	12 (25%)	36 (75%)	61.2-85.1	
Overall	413	102 (24.7%)	311 (75.3%)	70.9-79.2	< 0.001

1: IC 95% = 95% confidence interval; 2: Overlapping confidence intervals for prevalence = no significant difference.

Table 3: Seroprevalence of hepatitis E in pigs slaughtered at the SIVAC abattoir based on sex.

Sex	No. tested	No. negative (%)	No. positive (%)	Seroprevalence rate (%)	p value
Male	235	49 (20.9%)	186 (59.8%)	186/235 (79.1%)	0.115
Female	178	53 (29.8%)	125 (40.2%)	125/178 (70.2%)	
Overall	413	102 (100%)	311 (100%)	311/413 (75.3%)	

Sex-wise seroprevalence

Among the 311 positive cases, the majority were male (59.8%). Seroprevalence was 79.1% in males and 70.2% in females. There was no difference of seroprevalence by sex (p = 0.115) (Table 3).

Breed-wise seroprevalence by locality

Out of the four pig breeds, the lowest seroprevalence was recorded in the Duroc breed (59.1%) and the highest in the Landrace breed (85.9%). Analysis of the seroprevalence of the Duroc and Landrace breeds at the locality level revealed no significant difference (p = 0.706). In contrast, for the Large White and Piétrain breeds, there was a highly significant difference (p < 0.001) (Table 4).

Age-wise seroprevalence by locality

With regard to the age of the pigs, the highest seroprevalence rates were recorded in the 6-7 months age group (79.9%), followed by the 7-9 months age group (78.9%). Analysis of seroprevalence specific to each age group across the localities of origin revealed a highly significant difference (p < 0.001) (Table 5).

Links Researchers

Table 4: Breed distribution of total anti-HEV antibodies in pigs slaughtered at the SIVAC abattoir according to locality.

Breed	Total anti-HEV antibodies	Akoupé Zeudji	Attin-guié	Aza-guié	Binger-ville	Bou-aflé	KM17	Kotiés-sou	Port-Bouët	Sik-ensi	Sin-fra	Tou-modi	Overall	p value
Duroc	No. of positive animals/ No. of tested animals	2/4	0/0	0/1	9/13	0/0	0/0	0/0	1/3	0/0	1/1	0/0	13/22	
	Overall seroprevalence (%)	50	0	0	69.2	0	0	0	33.3	0	100	0	59.1	0.706
Landrace	No. of positive animals/ No. of tested animals	0/1	0/0	0/0	26/35	0/0	0/0	59/63	0/0	0/0	0/0	0/0	85/99	
	Overall seroprevalence (%)	0		0	74.3	0	0	93.7	0	0	0	0	85.9	0.706
Large white	No. of positive animals/ No. of tested animals	14/25	17/20	6/9	0/0	41/59	10/11	7/7	8/11	11/25	7/7	32/42	153/216	
	Overall seroprevalence (%)	56	85	66.7	0	69.5	90.9	100	72.7	44	100	76.2	70.8	<0.001
Piétrain	No. of positive animals/ No. of tested animals	1/3	4/5	3/4	17/25	14/14	1/1	14/15	0/1	0/0	2/2	4/6	60/76	
	Overall seroprevalence (%)	33.3	80	75	68	100	100	93.3	0	0	100	66.7	78.9	<0.001

Table 5: Age group distribution of total anti-HEV Antibodies in pigs slaughtered at the SIVAC abattoir according to locality.

Age group (month)	Total anti-HEV antibodies	Akoupé Zeudji	Attin-guié	Aza-guié	Binge-rville	Bou-aflé	KM17	Kotiés-sou	Port-Bouët	Sik-ensi	Sin-fra	Tou-modi	Overall	p value
5-6	No. of positive animals/ No. of tested animals	17/33	0/0	0/0	0/0	0/0	11/12	0/0	0/0	11/25	0/0	0/0	39/70	
	Overall seroprevalence (%)	51.5	0	0	0	0	91.7	0	0	44	0	0	55.7	< 0.001
6-7	No. of positive animals/ No. of tested animals	0/0	21/25	0/0	15/25	32/39	0/0	37/40	0/0	0/0	10/10	4/10	119/149	
	Overall seroprevalence (%)	0	84	0	60	82.1	0	92.5	0	0	100	40	79.9	< 0.001
7-9	No. of positive animals/ No. of tested animals	0/0	0/0	9/14	37/48	23/34	0/0	43/45	9/15	0/0	0/0	32/38	153/194	
	Overall seroprevalence (%)	0	0	64.3	77.1	67.6	0	95.6	60	0	0	84.2	78.9	< 0.001

DISCUSSION

Since its discovery in humans as a waterborne desease (Khuroo, 1980) and its first identification in pigs by Meng *et al.* (1997), Hepatitis E virus (HEV) is currently recognized as an emerging foodborne pathogen caused by the zoonotic genotypes HEV-3 and HEV-4 with pigs as the main reservoir. Although infected pigs are generally asymptomatic, they are risk for humans because the zoonotic genotypes can be transmitted through direct contact with and consumption of raw and undercooked infected pork products (Khuroo *et al.*, 2016; Wang and Meng, 2020). Hepatitis E is a public health issue. The most vulnerable groups are pregnant women, immunocompromised individuals and those exposed to pig industry (Galiana *et al.*, 2008). However, in Côte d'Ivoire, there is no information about HEV infections in pigs.

In the present study, we surveyed 413 apparently healthy domestic pigs originating from 11 localities across Côte d'Ivoire at the slaughterhouse of the Ivorian Slaughtering and Meat Processing Company (SIVAC). A high overall seroprevalence of 75.3% was found, demonstrating the wide exposure of domestic pigs to the virus. The high seroprevalence of total anti-HEV antibodies found can be compared with seroprevalence rates detected in studies in Africa using the same ELISA kit (MP Diagnostics) and the same pig populations (slaughtered pigs from abattoirs). Indeed, our result was higher than the 71.2% seroprevalence reported by Temmam *et al.* (2013) when 250 domestic pigs more than 6 months of age were tested in Madagascar. However, it is lower than the seroprevalence of 80% detected both by Traoré *et al.* (2015) in Burkina Faso, and Setondji *et al.* (2023) in Togo. Traoré *et al.* (2015) have tested 100 pig aged from 6 to over 18 months whereas Setondji *et al.* (2023) have analysed 176 pigs which were of 3-6, 6-12 and over 12 months of age. The differences in seroprevalence observed across those studies may be explained by variations in study design, including differences in age ranges and sample sizes of the populations investigated. However, as the kit used cannot distinguish between recent infection (IgM positive), past exposure (IgG positive) and active infection (IgM + IgG positive), the result found should be interpreted with caution and do not necessarily indicate active infection at the time of sampling. Nonetheless, the high seroprevalence may be indicative of sustained viral circulation within the herds studied. Further studies will be required using biological samples like liver and faecal to assess the HEV circulation.

The animals came mainly from Kotiéssou (20.6%), Bingerville and Bouaflé (17.7%, respectively) and Toumodi (11.6%). These localities are among the main localities supplying pork to the city of Abidjan which is the Economic capital of Côte d'Ivoire. They are characterized by the presence of large industrial farms, livestock-related structures, land access mechanisms and the agricultural environment which might have contributed to the proliferation of pig farming. Analysis of seroprevalence by locality of origin revealed a highly significant difference ($p < 0.001$), suggesting that factors such as herd management, biosecurity practices, or environmental conditions may contribute to these significant differences. Indeed, there is an intensification of local pig production resulting from strong demand for pork among the Ivorian population. The national pork production only covers 16% of consumption, compared with 84% for imported pork (MIRAH, 2022). Such practices can worsen sanitary conditions and farm management, thereby facilitating the rapid spread of infectious diseases, particularly zoonoses such as hepatitis E (Seni *et al.*, 2026). In addition to these factors, the small sample sizes in some localities in our study may also contribute to the highly significant difference.

The distribution by sex reflects a relatively uniform slaughter pattern at the SIVAC slaughterhouse ($p= 0.057$). There was no significant difference between male and female (79.1% and 70.2%, respectively, p-value= 0.115). Our findings are consistent with those observed in Madagascar by Temmam *et al.* (2013). The analysis shows that breeds are specific to the locality of origin. This could be explained by the fact that farmers often adopt the same breed as neighbouring farms to facilitate market access, share resources and knowledge, and benefit from a common veterinary network. Analysis of the seroprevalence of the Duroc and Landrace breeds at the local level revealed no significant difference ($p= 0.706$). This could be explained by their underrepresentation in the studied population due to the susceptibility to stress and physical fragility for the Landrace breed. As for the Duroc breed, it is characterised by slower growth and excess fat reserves (Sellier, 1986; Serres, 1989). In contrast, for the Large White and Pietrain breeds, there was a highly significant difference ($p < 0.001$). Both breeds are overrepresentated in the studied population likely reflecting their productive advantages such as reproduction and productivity (Sellier, 1986; Serres, 1989). The age of slaughtered pigs is also related to the locality of origin, with a high demand for pigs aged of 7-9 months. This pattern likely reflects the practice of slaughtering animals at ages that optimize feed efficiency and market value. The highest seroprevalence rates were recorded in the 6-7 months age group (79.9%), followed by the 7-9-months age group (78.9%). There was a highly significant difference of seroprevalence between age group across the localities of origin ($p < 0.001$). The differences could be explained by the infection of pigs from 6-7 and 7-9 months of age after the loss of maternal immunity at the age of 3-4 months (Andraud *et al.*, 2014; Capai *et al.*, 2019). In addition, This pattern could be due to long-term exposure of pigs to the virus, as reported in other studies where a higher seroprevalence of HEV in pigs of six months and above than in pigs below 6 months was observed (Liang *et al.*, 2014; Walachowski *et al.*, 2014).

Limitations of the study

Some limitations were noted in this study. Firstly, the convenience and cluster sampling methods used lead to statistical inaccuracy and an overrepresentation of some variables. In addition, the cross-sectional design cannot establish causality or temporal relationships. Secondly, the high seroprevalence found cannot assess the presence of HEV-positive pigs in the slaughterhouse, due to the kit detecting total antibodies. Indeed, the kit does not allow the detection of recent infection (IgM positive), past exposure (IgG positive) and active infection (IgM + IgG positive).

Similarly, the absence of PCR analyses has prevented the detection of viremic pigs among the seropositive animals. These data would have enabled an assessment of the risk of foodborne HEV infection in the human population of the study areas. Thirdly, the lack of information on the management of the originating farms has limited the in-depth interpretation of the results of the seroprevalence study. Despite these limitations, this study has given an initial indication of the seroprevalence of hepatitis E in pigs in Côte d'Ivoire.

CONCLUSION

This study provides the first data on the seroprevalence of total anti-HEV antibodies in domestic pigs in modern farms in Côte d'Ivoire. The high overall seroprevalence (75.3%) observed in pigs slaughtered at the national slaughterhouse and originating from 11 localities suggests that HEV is present in Côte d'Ivoire. The findings suggest that specific groups are at elevated risk: (1) farmers who handle live animals, carcasses, and offal during on-farm slaughter; and (2) slaughterhouse workers, pork retailers, and wholesalers who process animal carcasses and offal. The most common route of transmission is through contact with blood, carcasses, and offal. We recommend the use of personal protective equipment such as coats, gloves and boots, and hand washing. As these findings represent the only current indicators of HEV exposure in domestic pigs in Côte d'Ivoire, they hold important epidemiological value. These results will enable the awareness of hepatitis E in order to limit zoonotic transmission among key stakeholders.

ACKNOWLEDGEMENTS

The authors would like to thank the management and staff of the SIVAC slaughterhouse, as well as the farmers in the localities where the pigs originated for granting access to the slaughterhouse and allowing the collection of the blood samples mentioned in this article. The authors would also like to thank Dr. Edgard Valéry Adjogoua and Dr. Yahaya Sylla of the Pasteur Institute of Côte d'Ivoire, Adiopodoumé site, for their material and technical support during the serological analyses.

NOVELTY STATEMENT

This study provides the first data on the seroprevalence of hepatitis E in domestic pigs in Côte d'Ivoire.

AUTHORS' CONTRIBUTION

CMA: Study design, methodology, sample collection and processing, serological analyses, data interpretation, preparation of tables and figures, drafting of the first version of the manuscript, proofreading and corrections. BNA: Methodology, data interpretation, preparation of figures, proofreading and corrections. WAM-PD: statistical analyses and interpretation, preparation of tables. CBVS and IK: methodology, technical support for blood sampling at the SIVAC slaughterhouse. AJD and JQ: supervision of research on hepatitis E, proofreading and final corrections of the manuscript. All authors have read and approved the final version of the manuscript for publication.

Generative AI and AI assisted technology statement

The authors declare that no generative AI and AI assisted technology was used in the creation of this manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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