Research Article

Effectiveness of Slaughterhouse Blood as a Fly Attractant in a Cattle Farm

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Abstract | High fly populations in farms can reduce livestock productivity, threaten farmer health, and contaminate the environment. Therefore, effective control strategies are required. This study aimed to evaluate the effectiveness of slaughterhouse blood as a fly trap attractant in cattle farm. The experiment was conducted on a farm housing of 30 beef cattle with cleaned daily. Fly traps were constructed from 600 mL plastic bottles, and the experiment was conducted in two stages. The first stage included two treatments, T0 (the commercial attractant petrogenol® as control) and T1 (150 mL of cattle slaughterhouse blood), while stage II compared the best attractant from the first stage with three treatments, T1, T2, and T3, using 150 mL of cattle, goat, or sheep slaughterhouse blood, respectively. Each stage applied a completely randomized design with six replicates. Parameters observed were attractant durability, the species of flies trapped, and the number of trapped flies. Results showed that all slaughterhouse blood attractants were effective in attracting flies up to Day 7, with the highest numbers trapped on Day 4. Goat slaughterhouse blood was the most effective (P<0.01). The most frequently trapped species were *Musca domestica* (142.33±8.08 specimens/period) and *Chrysomya megacephala* (220.67±10.10 specimens/period), while petrogenol® was more effective at attracting fruit flies (*Bactrocera dorsalis*) (P<0.05). In conclusion, goat slaughterhouse blood shows promise as a natural fly trap attractant, and could be a useful for further evaluation within integrated fly management approaches. However, the present study assessed attraction performance only and did not evaluate fly population reduction.

Keywords | Bio-attractant, Cattle farm, Flies, Fly trap, Slaughterhouse blood

Received | November 21, 2025; **Accepted** | January 12, 2026; **Published** | February 06, 2026
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Citation | Aslimah S, Panjono, Atmoko BA, Amrullah AHK, Warman AT, Jannah ZN, Ariyadi B, Baliarti E (2026). Effectiveness of slaughterhouse blood as a fly attractant in a cattle farm. Adv. Anim. Vet. Sci., 14(2):435-442.
DOI | https://dx.doi.org/10.17582/journal.aavs/2026/14.2.435.442
ISSN (Online) | 2307-8316

INTRODUCTION

The cattle industry in Indonesia plays a significant role in supporting national food security by providing meat as a source of protein. However, efforts to increase production face several challenges, including disease outbreaks. Infectious diseases in livestock can be transmitted by vectors such as flies (Garfias *et al.*, 2021), which thrive in unsanitary environments rich manure, waste, and other decomposing organic matter. Furthermore, most Indonesian beef cattle are raised in smallholder, traditional farming systems (Baliarti *et al.*, 2021), where management often lacks proper sanitation, animal healthcare, and effective disease prevention strategies (Guntoro *et al.*, 2023). These conditions elevate the risk of fly-borne disease transmission, underscoring the need for preventive vector control.

Flies can transmit over 100 viral, bacterial, and parasitic disease, including myiasis, tuberculosis, anthrax, lumpy skin disease, and foot-and-mouth disease (Dardona *et al.*, 2014; Paslaru *et al.*, 2021). Furthermore, infestations can reduce milk yield and body weight, and cause abortions, infertility, and even mortality (Eom *et al.*, 2023), leading to economic losses for farmers. High fly populations in cattle farms affect animal health and productivity, and pose risks to workers and environmental quality. Therefore, the control of fly populations is essential. One effective method is using fly traps baited with attractants, substances that lure flies to a source (Sundar *et al.*, 2024; Azahra *et al.*, 2024). Natural attractants have garnered increasing attention, as chemical insecticides can lead to pest resistance, environmental contamination, and adverse effects on humans and animal health (Siddiqui *et al.*, 2023; Akkina and Estberg, 2018).

Several studies have examined natural attractants; but the use of livestock waste-based materials remains limited. A preliminary study indicated that a chicken egg-based attractant trapped more flies than the commercial product petrogenol® in cattle farms (Azahra *et al.*, 2024). This finding prompted the exploration of other livestock byproducts, such as slaughterhouse blood. Slaughterhouse blood is a potential attractant because due to its distinctive odor and biochemical composition, which are attractive to flies (Chiroque *et al.*, 2023; Lee *et al.*, 2025). Reported differences in the nutritional composition of cattle, goat, and sheep blood may influence their attractiveness to flies. In addition, slaughterhouse blood waste may cause environmental pollution if discarded without proper treatment.

Previous studies have reported that cattle, goat, sheep, and chicken blood can attract sand flies (Mong'are *et al.*, 2015; Yousefi *et al.*, 2020), but information is lacking on the use of livestock blood as an attractant for flies in cattle farm environments, where fly populations are influenced by livestock management and organic waste availability. Therefore, this study evaluated the effectiveness of slaughterhouse blood as a fly trap attractant in cattle farm. The findings could contribute to developing of an inexpensive, readily available, and environmentally friendly alternative for fly control.

MATERIALS AND METHODS

Experimental design

This field experiment used a completely randomized design in two stages. The first stage comprised two treatments, T0 (control using petrogenol®) and T1 (cattle slaughterhouse blood). The most effective attractant from the first stage tested further in the second stage by comparing it with other slaughterhouse blood types. In the second stage, three treatments were applied: T1 (cattle slaughterhouse blood), T2 (goat slaughterhouse blood), and T3 (sheep slaughterhouse blood). Six replicates were performed for each treatment.

Research site

The study was conducted at the beef cattle farm facility of the Livestock Development Center, Universitas Gadjah Mada. The facility is located in the city center, surrounded by residential and university areas in Yogyakarta, Indonesia. It consists of individual and colony pens housing a total of 30 beef cattle. Pens were cleaned daily between 07:00 and 08:00 AM. Cleaning involved removing feces from floors, cleaning feed troughs, and providing water to cattle and pen floors. Collected feces were disposed of in a dedicated waste area approximately 10 m from the pens. The pens were then rinsed with clean water to remove any remaining fecal residue and dirt.

Construction of fly traps

Fly traps were constructed from 600 mL plastic water bottles modified according to a method described previously (Azahra *et al.*, 2024). The bottle neck was cut below the shoulder, and the top portion was inverted and re-inserted without the cap. Holes were made on both sides to insert a wire for hanging the trap. The fly trap design used in this study is shown in Figure 1.

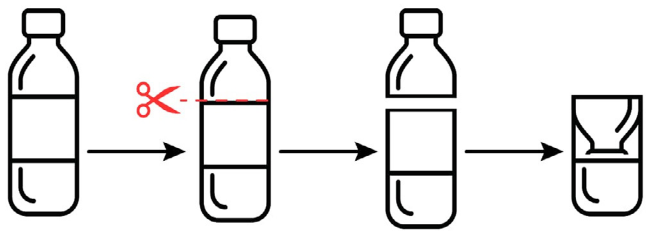

Figure 1: Fly trap design (Azahra *et al.*, 2024).

Preparation and application of attractant

The attractants used in this study consisted of cattle slaughterhouse blood, goat slaughterhouse blood, sheep slaughterhouse blood, and petrogenol®. Petrogenol® was obtained from a local market, while the cattle blood was collected from the Mancasan slaughterhouse, and the goat and sheep blood were collected from the Kentungan slaughterhouse, Sleman Regency, Yogyakarta. Blood was collected immediately after slaughter, placed in sterile plastic bags, and transported to the experimental site. A volume of 150 mL of blood was poured into each fly trap, while 1 mL of petrogenol® was applied to sterile cotton according to the manufacturer's instructions. Each attractant was tested in six randomly assigned pen compartments, with traps hung on pillars in areas inaccessible to cattle. The trap installation in the pens is shown in Figure 2. Traps were installed at 08:00, left for 24 h, and inspected at 08:00 AM the following day. Trap positions were rotated daily to control for location effects.

Figure 2: Fly trap installation in a cattle farm.

Data collection

Data collected included attractant durability and the species and number of flies trapped. Flies were collected daily at 08:00 AM. Attractants were not replaced during the observation period to assess durability. The durability of each attractant was observed until no flies were trapped during the 24 h treatment period. After collection, flies were rinsed with clean water to remove adhering blood and debris prior to morphological identification. After identification, specimens were briefly rinsed with 70% alcohol as a hygienic measure.

Fly species were identified by examining morphology and physical characteristics under a magnifying glass. Species were determined by comparing observed characteristics with taxonomic keys (Antoh *et al*., 2021; Garfias *et al*., 2021; Schinkel and Mengual, 2022; Kadja *et al*., 2023).

For analysis, the mean number of flies per replicated was calculated by using the following formula:

$$\text{Mean number of flies} = \frac{\text{Total number of flies trapped during the observation period}}{\text{Number of replicates per treatment}}$$

Daily mean trap catches were calculated by summing the flies captured from the six replicated for each treatment on each day and dividing by six. To analyze species composition over the full observation period, the total number of each species captured over 7 days per replicate was used to calculated a mean per replicate. This approach was used to compared differences in fly species attracted during the full observation period.

Data analysis

ANOVA was used to analyze daily number of flies trapped as well as the distribution of the number and species of flies trapped, followed by Duncan's Multiple Range Test was used to identify differences among treatments. All analyses were performed using SPSS software, version 27.

RESULTS

Attractant durability and number of trapped flies

Attractant durability and the number of flies trapped in the first stage are shown in Figure 3 and Table 1, while the results from the second stage are shown in Figure 4 and Table 2. Figure 3 shows that cattle blood and petrogenol® in attracted flies up to Day 7, with no flies trapped on Day 8. A clear difference in the number of flies trapped was evident between cattle blood and petrogenol®. Cattle blood began attracting flies effectively from Day 1. The mean number of trapped flies increased sharply from Day 2 (2.6 flies) to a peak on Day 5 (18.6 flies), then declined sharply on Day 6 (10 flies) and Day 7 (3.4 flies).

Table 1: Daily mean number of flies trapped for each treatment with corresponding ANOVA statistics (F-value, degrees of freedom, P-value) in Stage I.

	Days						
	1	2	3	4	5	6	7
Petrogenol	0.00	0.20	0.80	1.00	1.00	0.20	0.80
Cattle blood	1.00	2.60	9.00	12.20	18.60	10.00	3.40
SE	0.316	0.707	0.917	1.020	1.077	1.020	1.00
df	8	8	8	8	8	8	8
F-value	2.667	3.980	0.231	1.133	2.630	4.376	5.633
P-value	0.013	0.009	0.001	0.001	0.001	0.001	0.032

Table 2: Daily mean number of flies trapped for each treatment with corresponding ANOVA statistics (F-value, degrees of freedom, P-value) in Stage II.

	Days						
	1	2	3	4	5	6	7
Cattle blood	7.20^{b}	20.60^{b}	31.40^{b}	62.20^{b}	38.80^{b}	19.40^{b}	5.20^{b}
Goat blood	11.20^{c}	28.40^{c}	69.20^{c}	117.40^{c}	88.40^{c}	39.40^{c}	9.00^{c}
Sheep blood	3.40^{a}	11.60^{a}	22.40^{a}	35.00^{a}	16.00^{a}	7.20^{a}	2.40^{a}
SE	0.950	1.920	5.499	9.305	8.113	3.633	0.792
df	14	14	14	14	14	14	14
F-value	24.804	66.679	201.969	190.227	685.147	122.7311	29.927
P-value	0.001	0.001	0.001	0.001	0.001	0.001	0.001

^{a,b,c}Different subscription at the same column indicate significant different (P<0.05).

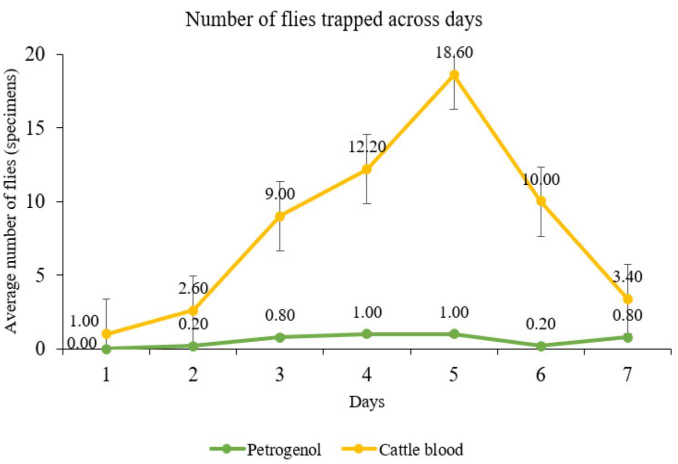

Figure 3: Daily mean number of flies trapped in fly traps using petrogenol® and cattle slaughterhouse blood during the observation period (n = 6 replicates per treatment). Error bars represent ± standard error (SE).

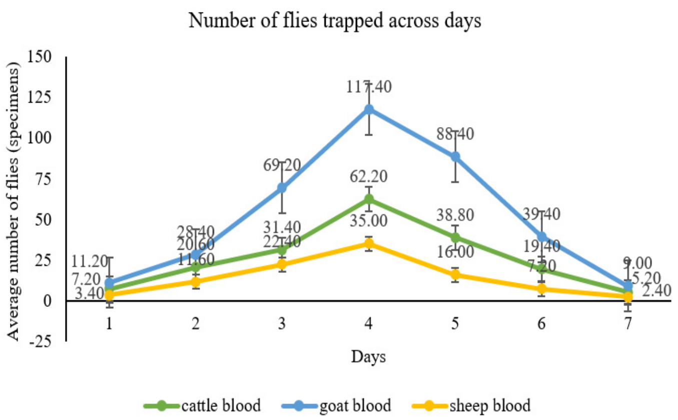

Figure 4: Daily mean number of flies trapped in fly traps using cattle, goat, and sheep slaughterhouse blood during the observation period (n= 6 replicates per treatment). Error bars represent ± standard error (SE).

In contrast, petrogenol® began attracting flies on Day 2, but numbers remined relatively low and stable throughout. Unlike cattle blood, which peak on Day 5, petrogenol® showed no pronounced peak and consistently trapped fewer flies. Overall, the mean number of flies trapped with petrogenol®, indicating its stronger attraction fo flies.

Figure 4 shows that the three types of slaughterhouse blood exhibited similar durability, attracting flies up to Day 7. All attractants were effective from Day 1. The number of trapped flies increased, peaking on Day 4, then gradually decline until Day 7. On Day 8, no flies were trapped.

Goat blood yielded the highest number of trapped flies, with a mean peak of 117.4 flies on Day 4. Cattle blood was the second most effective, peaking at of 62.2 flies, while sheep blood was least effective, reaching a maximum of 35.0 flies on Day 4. After Day 4, all three attractants experienced a sharp decline in the number of trapped flies. By Day 7, the mean number of trapped flies had decreased to 9.0 (goat blood), 5.2 (cattle blood), and 2.4 (sheep blood).

Table 3: Mean number and flies species trapped by different types of attractants at each research stage.

Stage	Flies species		
	Musca domestica	***C. megacephala***	***Bactrocera dorsalis***
Stage I			
Cattle blood	50.50±2.18	5.17±0.97	0.00±0.00
Petrogenol	1.17±0.49	0.00±0.00	2.83±0.74
P-value	0.001	0.001	0.005
Stage II			
Cattle blood	100.67 ± 5.87^{b}	84.17 ± 5.61^{b}	0.00 ± 0.00^{a}
Goat blood	142.33 ± 8.08^{c}	220.67 ± 10.10^{c}	0.00 ± 0.00^{a}
Sheep blood	57.00 ± 3.37^{a}	41.00 ± 1.81^{a}	0.00 ± 0.00^{a}
P-value	0.001	0.001	0.001

^{a,b,c}Different subscription at the same column indicate significant different (P<0.05).

Species and Number of Trapped Flies

Variation in fly species and numbers trapped across experimental stages and attractant types is presented in Table 3 and Figure 5. In the first stage, petrogenol® attracted only *Bactrocera dorsalis* (fruit fly), with a mean catch of 2.83±0.74 flies per period. Attractiveness to *Musca domestica* and *Chrysomya megacephala* was very low (1.17±0.49 and 0.0±0.0 flies per period, respectively). In contrast, cattle blood was significantly more effective ($P < 0.01$), catching a mean of 50.50±2.18 *M. domestica* and 5.17±0.97 *C. megacephala* per period.

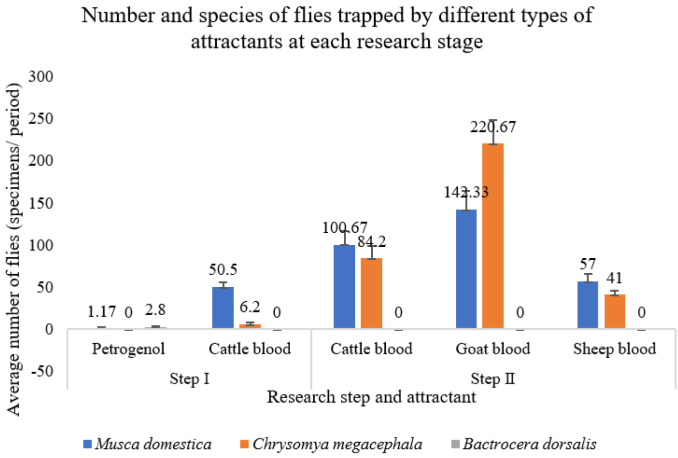

Figure 5: Number and species of flies trapped by different types of attractants at each research stage.

In the second stage, goat blood demonstrated significantly ($P < 0.01$) higher effectiveness, attracting a mean of 142.33±8.08 *M. domestica* and 220.67±10.10 *C. megacephala* per period. Cattle blood produced moderate captures (100.67±5.87 *M. domestica* and 84.17±5.61 *C. megacephala* per period), whereas sheep blood was least effective, attracting only 57.00±3.37 *M. domestica* and 41.00±1.81 *C. megacephala* per period. No *B. dorsalis* were trapped in the second stage, indicating that blood-based attractants were specific to house flies and blow flies, whereas petrogenol® was specific to fruit flies.

DISCUSSION

All attractants tested in both stages revealed were effective in attracting flies for up to seven days. The general pattern showed an increase in trapped flies from Day 1, peaking on Day 4, followed by a significant decline through Day 7. The increased effectiveness of slaughterhouse blood during the first four days is likely related to decomposition process, which produces strong odors. Blood contains proteins, lipids, carbohydrates, vitamins, and minerals, such as albumin, globulin, fibrinogen, and iron-rich hemoglobin (Chiroque *et al.*, 2023; Lee *et al.*, 2025). Decomposition releases compounds such as ammonia and other organic volatiles, which are highly attractive to flies. However, effectiveness gradually decreased over time as fly eggs and larvae appeared, accompanied by physical changes in the blood such as a partial coagulation, which may have influenced odor release and reduce overall attractiveness. Flies trapped in blood attractants are shown in Figure 6a.

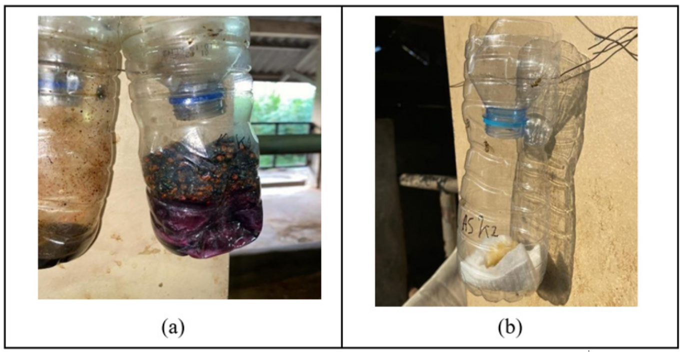

Figure 6: Flies trapped inside the blood attractant (a) and petrogenol® (b) traps during the observation period.

Goat blood proved to be the most effective attractant compared to petrogenol®, cattle blood, and sheep blood. This suggests that factors such as nutrient content, chemical composition, or organoleptic properties may contribute to its greater attractiveness. Previous studies reported that goat blood contains higher protein (6.51-6.97 g/dL) and glucose (38.58-45.33 mg/dL) levels than cattle or sheep blood (Hidayah *et al.*, 2025), which may intensify decomposition odors and enhance fly attraction. However, this study did not analyze the biochemical or volatile profiles of the blood samples, so the mechanisms underlying the superior performance of goat blood remain unclear. Further investigation is needed to clarify the factors underlying the higher attractiveness of goat blood.

In contrast, petrogenol® was significantly ($P<0.05$) less effective at attracting flies. This is likely because its main active compound, methyl eugenol, is specific to attracting fruit flies (*B. dorsalis*) (Mefta and Fauzana, 2021; Yusmaizah *et al.*, 2022). Methyl eugenol mimics female sex pheromones and is particularly effective for luring male fruit flies, but less so for for species such as *M. domestica* and *C. megacephala* commonly found in cattle environments. Figure 6b shows flies trapped using petrogenol®.

The effectiveness of blood attractants decreased after Day 4 due to prolonged exposure to sunlight and air, which altered the blood's physical condition and reduced odor intensity. Juniawan (2021) noted that organic odors and natural pheromones decline over time, reducing attractant effectiveness. Petrogenol® was effective at attracting *B. dorsalis* but trapped few *M. domestica*. This is likely because *M. domestica* prefers moist, organic-rich substrates (Matchinger *et al.*, 2014), which petrogenol® does not provide. In contrast, *B. dorsalis* responded more strongly to petrogenol® than to the other attractants ($P< 0.05$).

Meanwhile, slaughterhouse blood (cattle, goat, and sheep) effectively attracted *M. domestica* and *C. megacephala*. These species are highly sensitive to putrid odors from decomposed organic matter and are common in cattle farms due to their preference for moist substrates, animal feces, and feed residues (Park *et al*., 2019). Furthermore, *C. megacephala* feeds on substances such as sugar, milk, blood, and carrion and reproduces in liquid or semi-liquid media including blood, feces, and carcasses (Mohamed *et al*., 2021; Ngando *et al*., 2025). This species lays eggs in protein-rich substrates such as meat, manure, and carcasses (Dita *et al*., 2022; Irma *et al*., 2020) and is strongly attracted to the pungent odors of decomposed blood and organic matter (Rukmana and Utami, 2019).

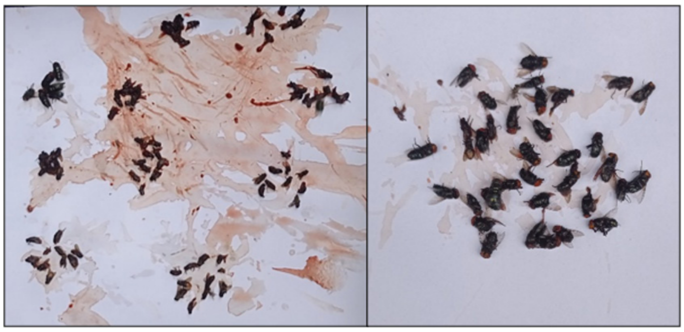

Figure 7: Flies removed from the blood attractant traps for counting and documentation.

It should be noted that this study measured attractant performance only by the number of flies trapped (Figure 7) and did not assess whether traps reduce overall fly populations on the farm. Therefore, it is unclear whether blood-based baits reduced populations or simply attracted flies. Nevertheless, these results provide preliminary evidence that slaughterhouse blood, particularly goat blood, can function as an effective natural attractant in livestock environments. Furthermore, the experiment includes no chemical or microbiological analyses to identify the volatile compounds responsible for attraction, limiting our understanding of the mechanisms underlying differences among blood types. Future studies should incorporate population monitoring and chemical profiling to evaluate whether these traps can effectively reduce on-farm fly population, elucidate the underlying attraction mechanisms, and assess implications for animal health and sustainable pest management.

CONCLUSION

All slaughterhouse blood types effectively attracted flies for up to seven days, with the highest capture occurring on Day 4. Goat blood was most effective, attracting the highest number of *M. domestica* and *C. megacephala*, while petrogenol® was specific to fruit flies (*B. dorsalis*). Therefore, goat blood has potential as a natural fly attractant for use in trapping systems in cattle farms. These findings are based on preliminary testing under field relevant conditions. Future studies should evaluate whether traps using goat blood lead to measurable reductions in overall fly populations and associated health risk, while clarifying the biochemical and physical factors underlying its greater attractiveness.

ACKNOWLEDGMENTS

The authors thank the Directorate of Research and Community Service, Ministry of Higher Education, Science, and Technology, Republic of Indonesia, for funding this research through the Fundamental Research (PFR) Scheme under contract 067/C3/DT.05.00/PL/2025; 2424/UN1/DITLIT/ DitLit/PT.01.03/2025. The authors also thank Veranika Kusuma Narulita Agustin and Bayida Roihatul Jannah for their assistance during data collection.

NOVELTY STATEMENT

This study is the first to evaluate and compare cattle, goat, and sheep slaughterhouse blood as natural fly attractants in a working cattle farm. Unlike previous research that focused primarily on sand flies, this study provides new evidence that goat blood is a highly effective attractant for major nuisance fly species such as *Musca domestica* and *Chrysomya megacephala.*

AUTHOR'S CONTRIBUTION

P and BAA conceived and designed the study. AHKA acquired the data, while SA and AHKA performed the data analysis and interpretation. The manuscript was drafted by SA, BAA, AHKA, and ATW, BA, EB, and ZNJ provided critical review and revision of the manuscript. All authors were approved the final manuscript.

Generative AI and AI-assisted technology statement

The authors declare that no generative AI or AI-assisted technologies were used to generate, analyze, or interpret the research data. Generative AI tools were used only to assist in improving the grammar and readability of the manuscript during the revision stage, and all scientific interpretations and conclusions are entirely the authors' own.

Conflict of interest

The authors have declared no conflict of interest.

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