

WALL GECKO CONTAMINATION OF A BOARDING SCHOOL MEAL SERVICE: AN OUTBREAK INVESTIGATION AND HACCP APPLICATION

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Author's contributions

This study was a collaborative effort of the authors. The author reviewed and approved the final version of the manuscript for publication.

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ABSTRACT

Macroscopic reptile contamination in institutional mass catering threatens food safety, triggers severe institutional anxiety, and introduces complex public health challenges. This report details the field investigation of a wall gecko (*Gekkonidae*) contamination event within a boarding secondary school and evaluates the application of a Hazard Analysis Critical Control Point (HACCP) framework. Following an institutional alert regarding a dead reptile found in a bulk food service cooler, a multi-disciplinary field investigation was conducted 36 hours post-incident. Methodology involved key informant interviews with food handlers, students, and administrative staff; an environmental walkthrough audit of the kitchen, dry store, and dining areas; and a retrospective cohort study (N=182) to analyze exposure-illness associations. A dead, physically intact wall gecko was discovered during a food replenishment service of oil rice at a specific dining table. Retrospective cohort analysis identified two cases of mild, non-febrile, watery diarrhea within 24 hours. The attack rate among the exposed cohort was 10.0% (1/10), compared to 0.58% (1/172) among the unexposed cohort. The association between developing gastrointestinal symptoms and consuming food from the contaminated cooler was not statistically significant (OR = 19.00; 95% CI: 1.01–356.55; p = 0.099). Structural and operational audits identified poor kitchen illumination, unmeshed ventilation crevices, exposed cobwebs in the dry store, and a lack of standardized covering protocols during food display and dishing intervals as primary risk factors. The presence of a wall gecko in institutional food service highlights critical vulnerabilities in operational hygiene. Mitigating these risks requires rapid administrative transparency, immediate clinical surveillance, and the systematic institutionalization of a proactive HACCP framework.

Key words: Food safety; wall gecko (*Gekkonidae*); Boarding school; HACCP; Outbreak Investigation; Nigeria.

INTRODUCTION

Mass catering facilities in boarding secondary schools exhibit unique structural and operational vulnerabilities to foodborne health hazards.(Olusanya, 2010) In these environments, a single systemic failure in food safety protocols can impact large, captive populations simultaneously, leading to acute public health crises, widespread institutional anxiety, and severe reputational damage.(Ali *et al.*, 2026; Gemedu *et al.*, 2024; Podlesnik & Raspor, 2026) While microbial, chemical, and microscopic biological contaminants are extensively documented, incidents involving macroscopic reptile vectors within active food service lines remain infrequently reported, despite presenting significant public health and psychological challenges. Wall geckos belonging to the family *Gekkonidae* is a ubiquitous, nocturnal, insectivorous ectotherm frequently found within domestic and institutional structures in tropical environments.(Fulgione *et al.*, 2019; Ramirez-Bautista *et al.*, 2006) Although wall geckos are not inherently venomous, they are recognized as potential mechanical vectors for zoonotic pathogens.(Nguyen *et al.*, 2018) Microbiological evaluations of geckos captured within catering environments demonstrate that their skin, feet, and intestinal tracts frequently harbor pathogenic organisms, most notably *Salmonella enterica*, *Staphylococcus aureus*, *Shigella* species, and various *Enterobacteriaceae*.(Nwachukwu *et al.*, 2020) These pathogens are shed via fecal deposition or direct physical contact, posing a high risk of acute gastroenteritis if introduced into consumable food items.(Nwachukwu *et al.*, 2020). Beyond the direct biological risks, the physical discovery of a macroscopic pest within a prepared meal creates an immediate psychological hazard, often inducing psychosomatic symptoms, acute stress reactions, and systemic panic among students and guardians.(Serpico *et al.*, 2021; Wang *et al.*, 2025) This panic can be exacerbated in the era of digital communication, where unverified reports on stakeholder platforms can outpace formal public health responses.(Nasution *et al.*, 2025; Yvonne Oshevwe Okoro *et al.*, 2024) This field report outlines the investigation of a wall gecko contamination event in a boarding secondary school in Bayelsa State, Nigeria. By combining traditional outbreak investigation methodologies with industrial Hazard Analysis Critical Control Point (HACCP) principles,(Awuchi, 2023) this paper provides a practical operational blueprint for public health physicians, school health administrators, and institutional managers to systematically identify structural entry points, manage stakeholder anxiety, and institute sustainable corrective measures within low-resource institutional catering systems.

METHODS

Investigation Trigger

A multi-disciplinary field outbreak investigation and environmental risk audit were initiated following an official administrative request by the school principal. The request was triggered by a systemic risk communication challenge because news of the reptile exposure had spread unofficially to the Parent-Teacher Association (PTA) digital messaging platform, generating acute stakeholder anxiety less than 24 hours prior to a scheduled institutional visiting day. The field investigator arrived at the facility 36 hours post-incident and 12 hours following the formal invitation. The overarching objectives of the investigation were to track the environmental source of the reptile, pinpoint the precise breakdown in food safety protocols, rule out intentional malicious food contamination, and establish a corrective framework. Due to shortness of time, ethical approval was not obtained. However, permission to conduct such studies was obtained from the State Ministry of Education. The principal obtained consent from the parents to invite professionals to conduct unbiased full-scale investigation; informed consent was obtained from all participating staff by a verbal consent. They were informed that the investigations were non-punitive and that no identifying names will be required during the interviews. Informed assent was further obtained from the participating students.

Data Collection and Cohort Study

To reconstruct the timeline and operational flow of the index dinner service, qualitative interviews were conducted using a structured, open-ended rapid assessment approach. Interviews were held with the school principal, school nurse, the four (4) kitchen cooks, and the student Lead Server who discovered the contaminant and reported in verbatim quotes. Concurrently, a retrospective cohort study was executed encompassing all students (N=182) who attended the index dinner service. Since students had permanent tables where they were usually served dinner, and persons on a particular table were served from same cooler, exposure was defined as consuming oil rice served from the specific bulk replenishment vessel (Cooler 14). A case was defined as any student within the institution

who developed acute gastrointestinal symptoms within a 48-hour window following the meal. Clinical logs at the institutional sickbay were independently reviewed by the investigator to cross-reference self-reported symptoms and validate case definitions.

Environmental Walkthrough and Hazard Analysis Audit

A physical walk-through audit of the entire food production chain was conducted. The spatial assessment spanned the dry food storage warehouse, the main cooking arena, the intermediate food dishing zones, the physical transport route from the kitchen to the refectory, the dining hall layout, and the solid waste disposal vectors. The audit utilized the foundational principles of the Hazard Analysis Critical Control Point (HACCP) system to evaluate structural integrity (presence of crevices, mesh vulnerabilities, lighting density) and behavioral hygiene compliance among the four food handlers.

RESULTS

Timeline Reconstruction and Immediate Countermeasures

On the evening of the incident, the kitchen staff completed the production of a bulk meal of oil rice. The student body completed an initial round of food service without incident. Following requests for secondary portions, the student Lead Server for Table 14 returned to the kitchen dishing area to obtain a food replenishment in the table's assigned bulk transport cooler (Cooler 14). Halfway through distributing and consuming this secondary round of food, the Lead Server observed a dead, physically intact wall gecko inside the cooler. The student immediately raised an alarm. School authorities executed rapid first-aid countermeasures. First, meal service was halted across the dining hall; active food portions remaining in pots, bulk coolers, and student plates were discarded; all catering utensils and vessels were isolated for sanitation; and the kitchen staff prepared an alternative replacement meal for the students that night. The school nurse physically isolated and inspected the reptile. The clinical audit noted that the gecko's body parts were completely intact, without signs of thermal degradation, cellular bloating, or tissue fragmentation. *"On my own examination when I saw the gecko, all the parts were complete..." (Nurse U.J)*. This critical forensic finding deduced that the reptile had not been boiled or stirred inside the primary industrial cooking cauldrons. Instead, it entered the food line during the post-preparation staging phase or during physical transport. A notable limitation identified in the initial response was that the vector was discarded without formal forensic photographic documentation. *"that's what I did not do, I was focused on calming the students, although Principal later ask them to go look for it where they throw it..." (Nurse U.J)*

Epidemiological Evidence and Clinical Outcomes

Clinical surveillance identified two cases of gastrointestinal illness within a 24-hour window following the event. Both cases presented with mild, self-limiting watery diarrhea; notably, neither case exhibited secondary constitutional symptoms such as a low-grade fever, abdominal cramps, or vomiting. Both individuals were managed with Oral Rehydration Therapy (ORT) and an empirical course of oral antibiotics, achieving full clinical resolution within 48 hours. The primary exposure path was defined as consuming food sourced from the specific bulk service cooler (Cooler 14) delivered to Table 14 during the secondary dishing interval. The distribution of exposure and clinical outcomes is summarized in the 2x2 contingency table below:

Table 1: A 2 by 2 contingency table showing relationship between exposure and outcomes

Exposure Status	Developed Diarrhea (Case)	Remained Healthy (Control)	Total	Attack Rate
Exposed (Ate from Cooler 14)	1 (a)	9 (b)	10	10.0%
Unexposed (Did not eat from Cooler 14)	1 (c)	171 (d)	172	0.58%
Total	2	180	182	1.10%

The attack rate among the exposed cohort was 10.0% (1/10), whereas the attack rate among the unexposed student population was 0.58% (1/172).

The Odds Ratio (OR) was calculated as:

$$OR = \frac{ad}{bc}$$

$$OR = \frac{1 \times 171}{9 \times 1}$$

$$OR = 19.00$$

The statistical analysis demonstrates that students who consumed food from the contaminated bulk cooler had 19 times higher odds of developing acute watery diarrhea compared to those who consumed meals from unaffected tables (OR = 19.00; 95% CI: 1.01–356.55). The very small number of cases limits the strength of the findings. The small sample size within the case cohort resulted in a wide confidence interval which reflects considerable uncertainty in the estimate with an association which was not statistically significant ($p = 0.099$ via Fisher's Exact Test). The solitary case identified in the unexposed cohort likely represents a baseline, sporadic incidence of non-specific dietary indiscretion or secondary hygiene variance unrelated to the reptile vector.

Root cause analysis

The qualitative interviews and physical walkthrough revealed significant gaps in behavioral food safety compliance and structural infrastructure.

Operational deficiencies: Following the initial dishing round, large bulk pots containing the remaining food were left completely uncovered in the kitchen area to facilitate rapid scooping during replenishment requests. Large service spoons and dishing ladles were left resting inside open pots or placed uncovered directly on un-sanitized kitchen counter tiles between serving intervals. There are only four kitchen cooks, however not all four are on duty at the same time. Student servers frequently transported replenishment food from the kitchen to the dining hall in bulk coolers.

Behavioral deficiencies: While female food handlers consistently utilized hair covers, male kitchen staff completely omitted head coverings during both preparation and dishing intervals, indicating inconsistent enforcement of baseline hygiene codes. Hand hygiene is also not consistently practiced by all kitchen staff.

Structural deficiencies: The kitchen and dry food storage walls exhibited extensive structural cracks and unsealed crevices. Structural ventilation openings and window frames lacked protective insect/vermin meshes, providing an unhindered pathway for nocturnal pests moving between external vegetation and the warmth of the kitchen. The food preparation and intermediate dishing zones suffered from extremely low illumination. Kitchen surfaces and high ceilings were heavily coated in dark soot and cobwebs, severely reducing contrast and blinding the four cooks to foreign objects or crawling pests entering open vessels. Additionally, storing open bags of staple crops (rice and garri) inside the dry store could also serve as an ecological attractant for insects, which in turn may draw predatory wall geckos directly into the active food staging perimeter.

APPLICATION OF THE HACCP PRINCIPLES

To transition the institution from a reactive posture to a preventive food safety system, a systematic Hazard Analysis Critical Control Point (HACCP) framework was conducted, (World Health Organisation, 1993) mirroring classic implementation science:

Conduct Hazard Analysis:

Biological Hazards: Mechanical transmission of zoonotic pathogens via wall gecko skin contact, tracking, or fecal shedding into uncovered post-cooking staging pots or open bulk service coolers.

Environmental/Physical Factors: Poorly lit kitchen, wall cracks, open ceiling gaps, unmeshed structural vents, and open storage of staple foods acting as an ecological attractant for insects and predatory reptiles.

Determine Critical Control Points (CCPs):

CCP-1 (Operational Staging): The temporal window between the first and second rounds of meal service within the kitchen area.

CCP-2 (Infrastructure Security): The dry storage warehouse and kitchen envelope boundaries.

Establish Critical Limits:

For CCP-1, food should remain covered whenever it is not actively being served. Full head cover compliance for 100% of kitchen personnel.

For CCP-2: Maximum diameter of structural wall cracks, window clearances, or mesh spaces restricted to prevent geckos from entering.

Establish Monitoring Procedures:

Visual double-checks of bulk pots by the lead kitchen supervisor before secondary dishing begins. Daily pre-service inspection of transport cooler lids by assigned student table representatives. Monthly physical walkthrough audits of wall structures and window mesh integrity by the Facilities Maintenance Officer.

Establish Corrective Actions:

If a vessel is found uncovered during staging, the top layer of food must be audited, and the food handler must be retrained on the spot. If a cooler lacks a functional matching lid, it must be decommissioned immediately and replaced from the reserve store before food leaves the kitchen. If wall cracks or mesh tears are identified, they must be patched or replaced with heavy-duty wire mesh within 48 to 72 hours.

Establish Verification Procedures:

Independent terminal medical logs tracking by the school nurse to audit for baseline gastrointestinal trends. Routine, unannounced school health environmental audits conducted every term by public health specialists.

Establish Record-Keeping and Documentation:

Institutionalization of a kitchen food-safety logbook documenting daily sanitization cycles, daily core illumination checks, and individual health certification logs for the four employed cooks.

DISCUSSION

The physical discovery of a macroscopic reptile vector within an institutional food line introduces a complex nexus of biological hazards, operational vulnerabilities, and acute psychosocial stress.(Nwachukwu *et al.*, 2020) While the field of institutional food safety frequently prioritizes microbial cultures or chemical toxins, this investigation highlights how larger environmental pests can act as structural breaches in public health surveillance. The epidemiological findings from this cohort study demonstrated a suspected relationship between the gastrointestinal illness and exposure to the contaminated food vessel. Although the small absolute number of clinical cases resulted in a wide confidence interval and a non-statistically significant relationship, the clinical timeline and attack rate support a point-source exposure vector. The absence of a low-grade fever or severe abdominal cramps, combined with the rapid response to Oral Rehydration Therapy (ORT) and empirical antibiotics, indicates a mild, self-limiting foodborne illness or localized gastroenteritis rather than a deep, invasive systemic infection like typhoid fever. To understand the biological plausibility of this contamination, reference must be made to the regional microbiological profile of the vector. Local research by Nwachukwu *et al.* evaluating the pathogenic footprint of wall gecko (*Hemidactylus frenatus*) droppings in Southern Nigeria isolated a dangerous array of public health bacteria. Their analysis revealed that gecko excretions frequently harbor *Salmonella* species, *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Bacillus* species.(Nwachukwu *et al.*, 2020) These organisms are known agents of acute foodborne gastroenteritis, working via pre-formed enterotoxins or localized mucosal inflammation. However, a major limitation of this study was that there was neither a microbiological examination of the gecko nor food nor stool sample. Therefore, the mechanism of illness was likely

driven by mechanical surface contamination or past fecal shedding by the reptile onto the interior surfaces of the bulk transport cooler or the staging utensils during the post-preparation interval. Operationally, the root-cause analysis identified that the presence of the vector was facilitated by a combination of behavioral omissions and structural deficits. The employment of only four cooks to cater to a large student population creates an intensive operational workload that can result in routine fatigue and lapses in basic food monitoring. Leaving massive pots completely uncovered between dishing intervals and transporting food in bulk coolers without matching lids created an ideal open window for opportunistic, insectivorous pests. Furthermore, the structural audit revealed an ecosystem that actively invited vermin. The lack of insect meshes on kitchen vents, coupled with unsealed wall crevices, allowed unhindered entry. This was severely compounded by poor, single-sided ventilation and low illumination. In poorly lit environments, kitchen workers cannot visually audit food surfaces effectively, allowing foreign objects or small pests to remain undetected during rapid meal distribution. Additionally, storing open bags of staple crops (rice and garri) inside the dry store served as an ecological attractant for insects, which in turn could draw predatory wall geckos directly into the active food staging perimeter. From a health administration perspective, this incident underscores the critical necessity of managing communication during public health emergencies. (Cruickshank *et al.*, 2025; Elfattah, 2024) The rapid dissemination of unverified reports on the Parent-Teacher Association (PTA) digital platform created an immediate communication crisis, threatening severe institutional panic and reputational damage just 24 hours prior to a major school visiting day. The school administration's decision to halt food service globally, discard all active food items, sanitize utensils, and immediately prepare an alternative meal represents a highly commendable exercise in containment and psychological first aid. However, a significant forensic limitation was the disposal of the reptile without capturing calibrated photographic evidence. For future institutional protocols, preserving the physical vector or obtaining high-resolution imagery is essential to support accurate public health taxonomy and forensic investigations.

CONCLUSION AND RECOMMENDATIONS

The occurrence of a wall gecko contamination event within an institutional dining service demonstrates that macroscopic pests represent a possible vector for foodborne contamination, institutional panic, and systemic risk. This investigation confirms that keeping catering facilities in a state of structural disrepair and allowing lapses in behavioral food coverage create environments highly vulnerable to biological hazards. Managing these crises requires a dual strategy: rapid administrative transparency to quiet stakeholder anxiety, and rigorous epidemiological methods to identify and isolate the source of contamination. Ultimately, safeguarding health security within boarding schools depends on replacing passive, reactive responses with a proactive, institutionalized HACCP framework, backed by consistent external audits conducted in collaboration with public health physicians.

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