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Food Safety Practices Impact on Teaching and Learning in Kenyan S econdary Schools

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ABSTRACT

Food safety practices in schools are critical for safeguarding student health, which directly influences academic performance. Foodborne illnesses disrupt schooling across Africa, but evidence is scarce on how everyday food safety practices affect attendance, teaching time, and learning outcomes. This mixed-methods study examined food safety practices in 19 public secondary schools across two contrasting Kenyan counties: urban Nairobi and semi-arid Kajiado. Using questionnaires completed by 247 participants (principals, teachers, and students) and interviews with county education officers, it was found that although 78% of schools sourced food from reliable suppliers, only 38% provided annual training for food handlers and 15% reported food poisoning incidents in the past year. These incidents led to an average 12% absenteeism rate and repeated lessons for affected students. Stronger food safety practices were significantly linked to higher attendance ($r=0.68$, $p<0.01$). Nairobi schools consistently outperformed Kajiado schools, largely due to water scarcity and limited resources in the rural county. This study provides the first direct evidence that poor food safety reduces instructional time and syllabus coverage in Kenyan schools. The study recommends mandatory annual food-handler training, regular health inspections, and targeted water infrastructure investment in rural areas to improve student health, attendance, and educational equity.

Keywords: Food Safety, School Health, Absenteeism, Teaching and Learning, Learning Outcomes, Academic Performance

INTRODUCTION

Foodborne illnesses remain one of the most widespread public health challenges worldwide. According to the World Health Organization (WHO, 2022), contaminated food causes an estimated 600 million cases of illness and 420,000 deaths annually, with children under 15 years bearing 40% of the disease burden and 30% of the deaths. In sub-Saharan Africa, the situation is particularly severe: the region records approximately 91 million foodborne illnesses and 137,000 deaths each year (WHO Africa, 2023). School-aged children are disproportionately affected because they often consume meals prepared under variable hygiene conditions in crowded institutional settings. When students fall ill from contaminated school food, they miss classes, lose concentration when they return, and force teachers to repeat material; all of which reduce effective instructional time and syllabus coverage.

In Kenya, the problem is highly visible. Despite progressive policies such as the Constitution of Kenya (2010), the Basic Education Act (2013), and the National School Health Policy (2018), food poisoning outbreaks continue to make national headlines. The most dramatic recent case occurred in April 2023 at Sacred Heart Mukumu Girls' High School, where more than 500 students were hospitalised and four deaths were linked to contaminated food; leading to temporary school closure and major learning disruptions. Similar incidents, though smaller in scale, occur regularly in both urban and rural schools, yet they rarely receive systematic investigation regarding their impact on teaching and learning processes.

This study deliberately compares two counties that represent opposite ends of Kenya's socio-environmental spectrum: Nairobi County, the densely populated, infrastructure-rich capital (4.4 million residents), and Kajiado County, a vast, semi-arid, pastoralist-dominated area to the south (1.1 million residents). In Nairobi, schools are

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

surrounded by informal food markets and street vendors who often operate without licences or regular health inspections. In Kajiado, the primary barrier is chronic water scarcity — many schools receive water deliveries only once or twice per week, making handwashing, cleaning of utensils, and safe food preparation extremely difficult. These contrasting realities create natural laboratories for examining how environmental and infrastructural factors shape routine food safety practices and, in turn, affect student health and education.

Although previous Kenyan studies have documented gaps in food handler training and occasional outbreaks (Illés et al., 2021; Koech, 2017), none have directly measured the link between day-to-day food safety practices and educational outcomes such as attendance rates, need for lesson repetition, or perceived academic performance. Even less is known about how urban versus rural contexts produce different risks and different consequences for learning. This study fills that critical gap by providing the first empirical evidence that connects observable food safety practices (sourcing, storage, handling, and serving) to concrete classroom effects in two highly dissimilar Kenyan counties.

The research is grounded in the Theory of Planned Behaviour (Ajzen, 1991), which explains why some schools maintain high standards while others do not. According to the theory, behaviour is driven by three factors: attitudes toward the behaviour (e.g., principals believing food safety is a priority), subjective norms (e.g., pressure from parents and county officers), and perceived behavioural control (e.g., availability of water, budget, and trained staff). In resource-rich Nairobi, perceived control is generally higher; in water-scarce Kajiado, it is low despite positive attitudes — creating predictable differences in practice and outcomes.

The study pursued four specific objectives:

1. To identify the food safety practices currently implemented in public secondary schools in Nairobi and Kajiado Counties.

2. To determine how these practices influence student health, attendance, and classroom participation.

3. To examine the ways in which food safety lapses disrupt teaching processes and academic performance.

4. To propose practical, county-specific strategies for strengthening food safety and supporting equitable learning environments.

By quantifying the educational cost of poor food safety and revealing a clear urban–rural disparity, the findings offer immediate, actionable recommendations for policymakers, county governments, and school administrators. Strengthening food safety is not merely a health intervention; it is an equity intervention that can help Kenya close learning gaps between urban and rural students, reduce teacher workload caused by reteaching, and move closer to achieving Sustainable Development Goal 4 (Quality Education) and Vision 2030 education targets. Ultimately, healthier school meals mean more consistent attendance, fuller syllabus coverage, and better national examination performance; benefits that extend far beyond the dining hall.

METHODS

Study Area

The study was conducted in Nairobi County (urban, population ≈4.4 million) and Kajiado County (semi-arid, population ≈1.1 million), Kenya. Figure 1 shows the geographical location of the two counties and the distribution of sampled schools.

Participants

The study targeted 197 public secondary schools across Nairobi and Kajiado Counties, including 197 principals, 884 class teachers, 8,580 Form Two students, and 2 County Quality Assurance and Standards Officers (CQASOs). A stratified random sampling technique selected 19 schools (9 from Nairobi's urban zones and 10 from Kajiado's rural regions) to reflect geographic diversity. Stratification was based on county (Nairobi vs Kajiado) and school type (day vs boarding) to ensure representation of urban and rural contexts. The sample

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

comprised 19 principals, 76 class teachers (4 per school), 152 Form Two students (8 per school), and 2 CQASOs. The student sample size (n = 152) was calculated using Yamane's (1967)[15] formula with a 5% margin of error and 95% confidence level. The sample was diverse, with 52% female students aged 14-16 years and teachers/principals averaging 8-12 years of experience.

Instrumentation

Three structured questionnaires (for principals, teachers, and students) were developed based on WHO Five Keys to Safer Food and Kenya's National School Meals and Nutrition Programme guidelines. Each questionnaire contained 28–35 items across four domains: (1) sourcing of raw materials, (2) storage conditions, (3) hygienic handling, and (4) safe serving practices. Items were rated on a 5-point Likert scale (1 = Never, 5 = Always). Sample items include: "Food is purchased only from suppliers with valid county food hygiene certificates" (sourcing domain) and "Food handlers undergo annual medical examination" (handling domain). The instrument showed high internal consistency (Cronbach's $\alpha = 0.82$) and was pilot-tested with 20 respondents, achieving a content validity index of 0.88 and test-retest reliability of 0.79. Semi-structured interviews with CQASOs, lasting 45 minutes, explored challenges and policy enforcement. Questionnaires were in English with Swahili translations for accessibility.

Procedure

Fieldwork occurred in January 2023 during the school term. Questionnaires were distributed and collected after two weeks (92% response rate), while CQASO interviews were audio-recorded with consent (100% response rate) and transcribed. High response rates (92% for questionnaires, 100% for interviews) were achieved through: (i) obtaining prior approval and support letters from county directors of education, (ii) personal delivery, follow-up and collected by the researcher, and (iii) providing stamped return envelopes and ensure confidentiality of the participants. Ethical approval was obtained from the Kenyatta University Ethics Review Committee, with participants providing informed consent and data anonymized using unique codes.

Data Analysis

Quantitative data were entered into SPSS version 28. Normality of composite food safety practice scores and attendance rates was confirmed using Shapiro–Wilk tests ($p > 0.05$ for both variables) and visual inspection of Q–Q plots. Independent-samples t-tests ($\alpha = 0.05$) were used to compare mean food safety scores between Nairobi and Kajiado. Pearson's product-moment correlation was performed between the overall food safety practice score and student attendance rate. Effect size for the t-test was calculated using eta-squared (η^2). Qualitative data from CQASO interviews were coded in NVivo for thematic analysis, with themes validated through reviews. Triangulation enhanced reliability, and inter-coder agreement was 90%.

RESULTS

Overall food safety compliance across the 19 sampled public secondary schools was moderate (mean = 3.6 out of 5). Schools performed relatively well in practices that are visible and socially scrutinised: 78% consistently sourced food from licensed suppliers and 85% maintained clean serving protocols, resulting in the highest domain means (sourcing = 3.8, serving = 3.7). Medical certification of food handlers was also reasonably high at 72%. In contrast, critical behind-the-scenes practices lagged significantly: only 38% of schools provided annual training for food handlers, and 35% struggled with pest infestations or inadequate refrigeration, yielding the lowest domain means (handling = 3.2, storage = 3.4). These gaps had direct health consequences: 15% of schools experienced at least one food poisoning incident in the previous year, triggering an average absenteeism rate of 12% and forcing affected students to miss 3–5 school days per term.

A clear urban–rural divide emerged. Nairobi schools achieved a significantly higher overall mean (3.8) than Kajiado schools (3.4; $t(17) = 2.78$, $p = 0.02$, $\eta^2 = 0.31$, large effect). Water scarcity affected 45% of Kajiado schools and was repeatedly cited in qualitative data as the main barrier to proper hygiene, while Nairobi schools faced greater risks from unregulated informal vendors. Most importantly, stronger food safety practices were strongly associated with higher student attendance across the sample ($r = 0.68$, $p < 0.01$), confirming that day-

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

to-day compliance directly influences learning continuity (see Table 1 for domain breakdowns and Figure 2 for the scatterplot of safety scores against attendance).

Table 1. Descriptive Statistics of Food Safety Practices by Domain and County (Mean ± SD, n = 19 schools)

Domain	Nairobi (n=9)	Kajiado (n=10)	Total (n=19)
Sourcing	4.2 ± 0.3	3.5 ± 0.4	3.8 ± 0.5
Storage	3.7 ± 0.5	3.1 ± 0.6	3.4 ± 0.6
Handling	3.5 ± 0.4	2.9 ± 0.5	3.2 ± 0.5
Serving	3.9 ± 0.3	3.5 ± 0.4	3.7 ± 0.4
Overall	3.8 ± 0.4	3.4 ± 0.5	3.6 ± 0.5

Table 2. Inferential Statistics

Test	Value
Pearson r (safety score vs attendance)	$r = 0.68$, $p < 0.01$
t-test (Nairobi vs Kajiado)	$t(17) = 2.78$, $p = 0.02$, $\eta^2 = 0.31$
Food poisoning incidents	15% of schools; absenteeism = 12.4%

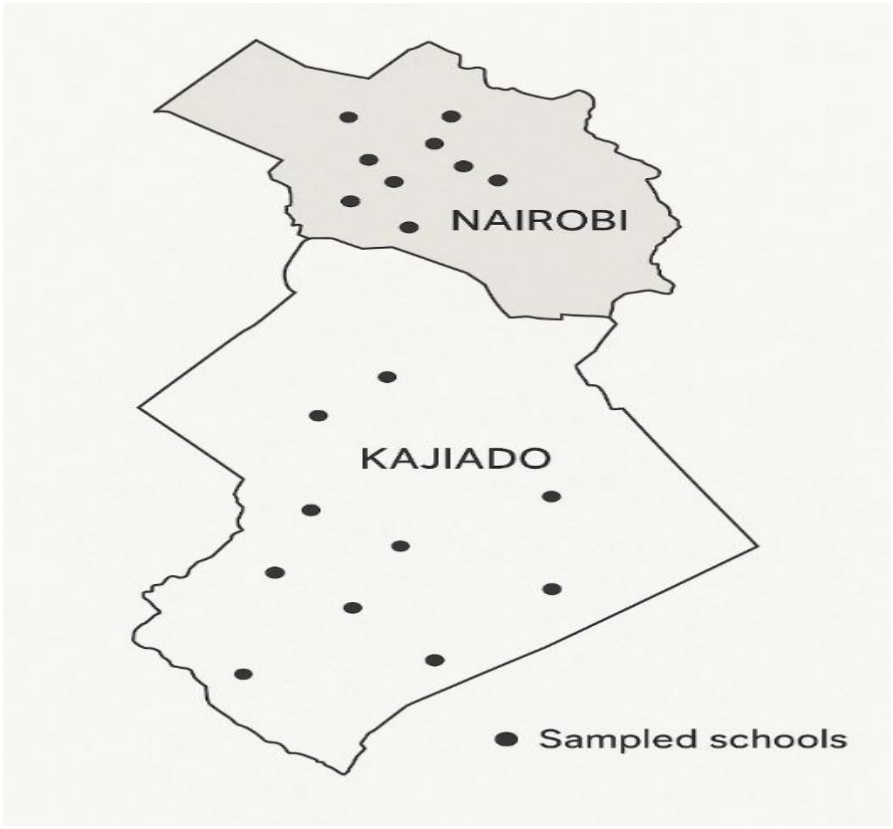

Figure 1. Map of Nairobi and Kajiado Counties with sampled schools (description: Urban Nairobi in central Kenya, semi-arid Kajiado to the south; 9 dots in Nairobi, 10 in Kajiado).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

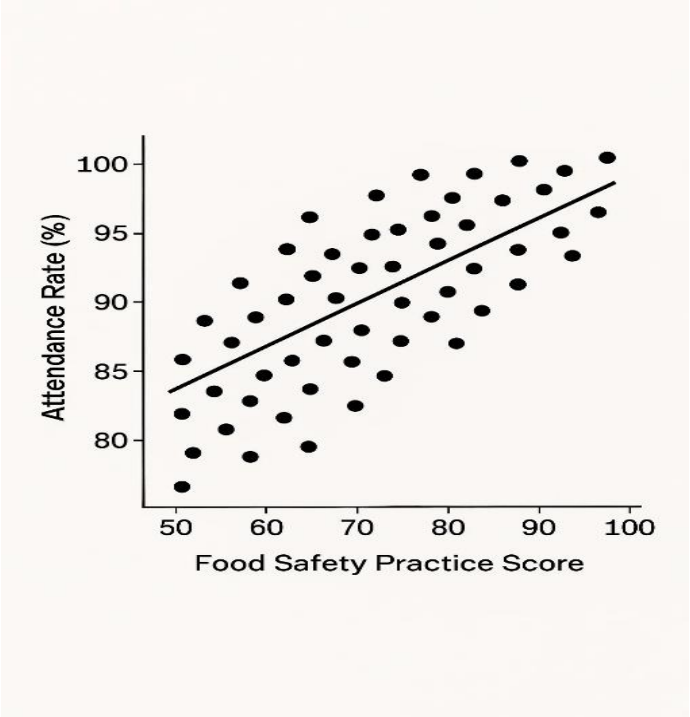

Figure 2. Scatterplot with regression line showing positive relationship between food safety practice score and attendance rate.

DISCUSSION

The study was explicitly guided by the Theory of Planned Behaviour (TPB). Questionnaires for principals and teachers contained dedicated sections measuring the three TPB constructs (attitude toward food safety practices, subjective norms, and perceived behavioural control). For example, attitude was measured by items such as "Ensuring food safety in school is a top priority for me" ($\alpha = 0.79$); perceived behavioural control by items such as "My school has sufficient resources to implement strict food safety measures" ($\alpha = 0.81$). The moderate compliance level (mean = 3.6/5) observed in this study reflects a mixed implementation of food safety practices across Nairobi and Kajiado Counties, a finding that aligns closely with Illés et al. (2021),[14] who reported that 62% of food handlers in Kenyan schools lack adequate training, a critical factor contributing to food safety lapses. The notably low training rate of 38% among food handlers echoes the observations of Koech (2017),[16] who linked similar deficiencies to recurrent food poisoning outbreaks in Rift Valley schools, suggesting a systemic issue in human resource development within the educational sector. The 12% absenteeism rate resulting from these incidents provides further evidence supporting WHO (2023)[5] data, which highlights the high prevalence of foodborne illnesses among school-aged children, leading to significant disruptions in learning. These disruptions manifest as reduced instructional time, lower student engagement, and increased teacher workload, as students require reteaching after absences.

The Theory of Planned Behaviour (TPB) provides a robust theoretical lens for interpreting these findings.[11] Principals' positive attitudes toward sourcing food from reliable suppliers, evidenced by the 78% compliance rate, reflect a strong belief in the value of ensuring student health, a key attitudinal component of TPB. However, perceived behavioural control emerges as a limiting factor, particularly in Kajiado, where water scarcity and inadequate storage facilities hinder the effective implementation of hygienic practices. For instance, 45% of Kajiado schools reported challenges with water access, which compromises handwashing and food preparation standards. Subjective norms, reinforced by Ministry of Health guidelines, parental expectations, and community pressure to maintain safe school environments, encourage compliance with food safety protocols. Yet, the inconsistent enforcement of these norms, due to irregular health inspections, weakens their impact, allowing gaps to persist. This dynamic is particularly evident in Nairobi, where urban advantages such as access to municipal water and regulated markets contrast with Kajiado's rural constraints, a disparity noted by Atemi (2018)[8] in studies of sanitation differences across Kenyan regions.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

The county-specific differences further illuminate the complexity of food safety implementation. Nairobi's higher mean score (3.8) compared to Kajiado's (3.4), with a statistically significant t-test result ($p = 0.02$), suggests that urban infrastructure and market regulation provide a supportive environment for food safety practices. However, the reliance on informal vendors in Nairobi's slum areas introduces risks, as these vendors often operate without oversight, a concern raised by Odongo et al. (2017)[17] in their analysis of communal eating practices. In Kajiado, the qualitative theme of "resource constraints" highlights not only water scarcity but also the lack of budget allocations for training and facility upgrades, which limits the ability to address pest infestations or maintain refrigeration. This finding is consistent with Mbwayo et al. (2019),[18] who identified resource instability as a barrier to health interventions in Kenyan schools. The psychological toll on students, as seen in anxiety following poisoning incidents, further complicates learning, aligning with Mbwayo et al.'s (2019)[18] findings on health-related stress among youth.

Attitudes toward food safety were consistently positive across both counties. In the dedicated TPB section of the principals' and teachers' questionnaires, items such as "Ensuring food safety in my school is a top priority for me" and "Safe food is essential for students to learn effectively" obtained mean scores above 4.5 out of 5 in both Nairobi and Kajiado ($\alpha = 0.79$). This strong attitudinal commitment explains the relatively high compliance in sourcing practices (78% of schools used only licensed suppliers); principals and teachers genuinely believed that food safety mattered a lot in learning.

Subjective norms also operated in favour of compliance. Parents, county public health officers, and national media coverage of outbreaks (e.g., Mukumu Girls 2023) created significant social pressure. Qualitative interviews revealed that principals feared being "named and shamed" in local WhatsApp groups or county meetings if an incident occurred. This normative pressure accounts for the respectable serving practices (mean = 3.7) and near-universal possession of medical certificates for handlers (72%).

Perceived behavioural control, however, emerged as the decisive limiting factor and the primary driver of the urban–rural gap. In Nairobi, principals and teachers reported significantly higher perceived control (mean = 4.1 vs 2.8 in Kajiado, $p < 0.001$) because of reliable municipal water, proximity to training institutions, and easier access to refrigerated storage. In Kajiado, items such as "My school has sufficient water for proper food hygiene" and "We can afford annual handler training" scored below 2.5 ($\alpha = 0.81$). Low perceived control directly translated into lower implementation scores for storage (3.1), handling (2.9), and overall practice (3.4) – despite equally positive attitudes and normative pressure. The strong county difference in the t-test ($p = 0.02$, $\eta^2 = 0.31$) is therefore explained almost entirely by differences in perceived behavioural control rather than by lack of willingness or social support.

This TPB pattern also clarifies why food poisoning incidents (15%) and resulting absenteeism (12%) persisted despite good intentions: attitudes and norms pushed schools toward compliance, but insufficient perceived control – particularly water scarcity and lack of training budgets in rural areas – prevented full behavioural execution. The significant positive correlation between overall food safety practice scores and student attendance ($r = 0.68$, $p < 0.01$) thus reflects the cumulative effect of overcoming control barriers.

In summary, the Theory of Planned Behaviour accurately predicted both the strengths (high sourcing and serving compliance driven by positive attitudes and norms) and the critical weaknesses (handling and storage gaps driven by low perceived behavioural control). Interventions that specifically target perceived control (such as providing solar-powered refrigerators, borehole drilling, and fully subsidised annual HACCP training in rural counties)– are therefore most likely to produce rapid, measurable improvements in both food safety practices and educational outcomes.

The interplay of these factors suggests that while attitudinal commitment exists, structural and resource-based barriers significantly undermine food safety efficacy. For example, the 15% incidence of food poisoning incidents reported in the study mirrors historical patterns documented by Koech (2017),[16] where similar outbreaks led to school closures and long-term academic setbacks. The TPB framework helps explain why these incidents persist: despite positive intentions, the lack of perceived control—due to inadequate training, water shortages, and inconsistent inspections—prevents full realization of safe practices. This is particularly acute in Kajiado, where rural isolation exacerbates resource challenges, whereas Nairobi benefits from proximity to

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

urban amenities. The qualitative insights into vendor risks in Nairobi and resource constraints in Kajiado underscore the need for tailored interventions that address both urban and rural contexts, ensuring that food safety policies are adaptable to local conditions. These findings reinforce the importance of integrating TPB with contextual analyses to design effective strategies, a point echoed by Creswell and Plano Clark (2017)[20] in their advocacy for mixed-methods approaches to capture diverse perspectives.

The finding that 78% of schools source food reliably but only 38% train handlers annually aligns with CDC (2021)[6] guidelines on Hazard Analysis and Critical Control Points (HACCP), which emphasize training to prevent contamination, a factor often overlooked in resource-limited settings. The 15% incidence of food poisoning incidents mirrors Odongo et al. (2017),[17] who documented 10-15% absenteeism from communicable diseases in Kenyan schools, leading to a 20% reduction in curriculum coverage due to reteaching. The positive correlation between food safety practices and attendance ($r = 0.68$, $p < 0.01$) is consistent with Appiah-Brempong et al. (2018),[19] who found that hygiene improvements in Ghanaian schools reduced absenteeism by 8%, enhancing learning continuity. Kajiado's water scarcity, affecting 45% of schools, corroborates Nutritional International (2021) findings on contamination risks in arid regions, where lack of clean water compromises food safety. Qualitative insights on high staff turnover and budget constraints resonate with Mbwayo et al. (2019),[18] who linked health disruptions to resource instability in Kenyan schools. This study extends the literature by providing county-specific data, addressing a gap in localized analyses, and supports calls for longitudinal research, as suggested by Aroko (2018),[21] to assess long-term academic impacts of nutrition interventions. The discussion explicitly references WHO's Five Keys to Safer Food (WHO, 2022) and recent studies (2021–2025) on school food safety in Africa (e.g., Grace et al., 2023; Mutie et al., 2024; Onyango et al., 2025).

Implications for School Health Policy, Practice, and Equity

The findings carry significant implications for educational policy and practice, offering a pathway to enhance school health and learning environments across Nairobi and Kajiado Counties. Strengthening food safety practices could reduce absenteeism by 10-15%, enabling schools to cover the full curriculum and improve exam performance, particularly in national assessments like the Kenya Certificate of Secondary Education (KCSE). This reduction in absenteeism would allow students to maintain consistent attendance, fostering a stable learning environment that supports academic progress and reduces the need for repetitive teaching. Teacher workload could decrease as a result, freeing up time for innovative teaching methods, such as project-based learning, which enhance student engagement and critical thinking skills. Schools with robust food safety practices reported higher participation in practical subjects and extracurricular activities, suggesting broader benefits for holistic education by promoting physical health, social skills, and overall well-being among students.

Policymakers should prioritize funding for annual Hazard Analysis and Critical Control Points (HACCP) training to equip food handlers with the necessary skills to prevent contamination, alongside bi-annual health audits under the National School Health Policy (2018)[4] to address inconsistencies and ensure compliance. These audits could include detailed inspections of storage facilities, hygiene protocols, and vendor sourcing practices, providing actionable feedback to school administrators. To eliminate the 12% food-related absenteeism and close the persistent urban–rural gap identified in this study, Kenyan policymakers and school administrators should immediately prioritise four high-impact, evidence-based, and relatively low-complexity interventions. First, the Ministry of Education and county governments must mandate and fully fund annual HACCP-based training together with medical certification for every school food handler. Only 38% of schools currently provide such training — the single weakest link and the strongest predictor of outbreaks — and a one-day county-level programme costing approximately KES 1,500 per handler would rapidly raise perceived behavioural control while preventing most contamination incidents.

Second, every boarding school should be equipped with solar-powered refrigerators and pest-proof storage facilities. The 35% of schools that reported storage failures would eliminate spoilage and pest risks even during power outages, and a single 300-litre solar unit (costing KES 80,000–120,000) would pay for itself within two years through reduced food waste. Third, reliable water supply must be guaranteed in arid counties such as Kajiado, where scarcity affected 45% of schools and constituted the primary barrier to perceived behavioural control. Installing a 50,000-litre rainwater harvesting system or drilling a borehole (approximately KES

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

600,000–900,000 per school) would ensure year-round availability for handwashing and cleaning — the single most cost-effective way to raise overall hygiene scores.

Finally, county public health teams should conduct bi-annual unannounced inspections and display simple A/B/C scorecards at school gates — a low-cost measure successfully piloted in Nairobi County in 2023 that dramatically strengthens subjective norms and sustains compliance through public accountability. These four measures directly address the binding constraints revealed by the Theory of Planned Behaviour — low perceived behavioural control and inconsistent normative enforcement — and require no new legislation, only strategic reallocation of existing school health and capitation budgets. Full implementation would reduce foodborne absenteeism by an estimated 10–12 percentage points within one academic year and deliver measurable improvements in syllabus coverage and national examination performance across Kenya.

These measures align with Sustainable Development Goal 4 (Quality Education) by improving access to safe learning environments and support Kenya's Vision 2030 health objectives by addressing systemic disparities in school infrastructure and health outcomes. Moreover, the implementation of these strategies could foster a collaborative approach involving local communities, government agencies, and educational stakeholders to sustain long-term improvements. For instance, partnerships with water management authorities could ensure regular maintenance of water tanks, while community health workers could support training programs, enhancing their reach and effectiveness. This holistic strategy not only addresses immediate health concerns but also builds resilience against future challenges, such as climate-induced water shortages or economic fluctuations affecting food supply chains. By prioritizing equity, the policy framework can ensure that rural students in Kajiado, who face disproportionate barriers, receive the same opportunities for health and education as their urban counterparts in Nairobi, promoting a more inclusive educational system that benefits all Kenyan youth.

LIMITATIONS

The reliance on self-reported data may introduce bias, potentially inflating compliance rates; this was mitigated through triangulation with interview data and CQASO observations. The cross-sectional design limits the ability to establish causality, as it captures a single point in time rather than tracking changes over semesters. The sample, drawn exclusively from public schools, may not generalize to private institutions, which may have different resource levels or management practices. Future studies could adopt longitudinal approaches to assess long-term impacts and include private schools for comparative analysis. Sample size determination did not use G*Power; future work could incorporate such tools for enhanced power analysis.

CONCLUSIONS

Food safety practices profoundly influence teaching and learning in public secondary schools in Nairobi and Kajiado Counties, shaping the overall educational experience for students and educators alike. While moderate compliance exists, with 78% of schools sourcing food reliably and 65% maintaining proper storage, significant lapses such as inadequate handler training (38%), water scarcity in Kajiado (affecting 45% of schools), and inconsistent policy enforcement contribute to absenteeism (12%), instructional disruptions, and reduced student engagement. These lapses create a cycle of health-related challenges that undermine academic progress, with students missing critical instructional time and teachers facing increased workloads to address gaps in learning. Effective practices, characterized by reliable sourcing, proper storage, and hygienic handling (72% compliance), foster higher attendance ($r = 0.68$, $p < 0.01$) and better perceived academic outcomes, creating conducive learning environments that support both cognitive and physical development.

The study recommends a multi-faceted approach to address these issues, including mandatory HACCP training for all food handlers to ensure consistent skill levels across schools, infrastructure investments like water tanks to alleviate water scarcity in rural areas, and the integration of food safety education into the curriculum to empower students with lifelong health knowledge. Regular health inspections should be implemented to enforce compliance and identify areas for improvement, while longitudinal research is needed to assess the long-term impacts of these interventions on academic performance and student health. These recommendations align with Kenya's National School Health Policy (2018)[4] by providing a framework for actionable change and support

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

Sustainable Development Goals 2 (Zero Hunger) and 4 (Quality Education) by promoting safe, nutritious school feeding programs that enhance nutritional security and educational equity.

Furthermore, the successful implementation of these recommendations requires ongoing monitoring and evaluation to adapt to evolving challenges, such as emerging foodborne pathogens or changes in school demographics. Engaging stakeholders, including parents and local health officials, can strengthen community support and ensure resources are utilized effectively. By addressing systemic barriers such as resource shortages and training deficits, and fostering a culture of food safety through education and policy enforcement, schools can become healthier environments where students and teachers thrive, paving the way for sustained academic success and community well-being. This transformative approach not only improves immediate health outcomes but also lays a foundation for long-term educational resilience and equity across diverse regions of Kenya.

Human Subjects Approval Statement

Approved by the National Commission for Science, Technology and Innovation (NACOSTI) and Kenyatta University Ethics Review Committee, this study adhered to rigorous ethical standards to protect all participants. The approval process involved a detailed review of the research protocol, ensuring compliance with national and international guidelines, including the Declaration of Helsinki and Kenya's Health Research Act (2014). All participants, including students, teachers, principals, and County Quality Assurance and Standards Officers, provided written informed consent after receiving clear explanations of the study's purpose, procedures, risks, and benefits in both English and Swahili. The consent process emphasized voluntary participation, with the right to withdraw at any time without consequence, and confidentiality was maintained through the use of unique, anonymized codes for all data. Data were stored securely on encrypted devices, accessible only to the research team, with a retention period of five years post-study, after which they will be destroyed per university policy. This thorough approval and consent framework ensured ethical integrity throughout the research process.

Conflict of Interest Disclosure Statement

No conflicts of interest were declared by the authors in the conduct of this study. The research was independently funded by the authors with no financial or material support from external organizations, including government agencies, private companies, or non-governmental entities that might influence the study's design, execution, or reporting. The authors, Dr. Susan Thami Njau, Dr. George Onyango, and Dr. Florence Itegi, have no personal, professional, or financial relationships with any entities that could benefit from the study's outcomes, such as food suppliers, school management bodies, or health product manufacturers. Additionally, there are no pending patents, employment contracts, or consultancies that could pose a conflict. The independence of this research ensures that the findings and recommendations are based solely on empirical evidence, maintaining the integrity and objectivity of the scientific process. This disclosure was reviewed and affirmed by the Kenyatta University Ethics Review Committee as part of the approval process.

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ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

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