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Bacterial Contamination of External Door Handles in Small Retail Shops in Qasr Bin Ghashir, Libya: A Cross-Sectional Survey

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ABSTRACT

Background: Door handles represent frequently touched surfaces that may act as vehicles for microbial transmission. In regions with high temperature and strong sunlight, the survival of microorganisms on such surfaces can be influenced, yet data from community settings remain limited. Methods: This cross-sectional study examined 25 external door handles from retail shops in Qasr Bin Ghashir, Tripoli (15 food stores and 10 butcheries). Sterile swabs were collected and inoculated onto nutrient, blood, and MacConkey agar. Plates were incubated at 37 °C for 24–48 hours, and colony-forming units (CFU) were categorized into <10, 10–100, 101–1000, and >1000. Isolates were identified by morphology, Gram stain, and standard biochemical tests. Results: The predominant CFU category was 10–100 (40%). Bacillus spp. (35%) and coagulase-negative staphylococci (27%) were the most frequent isolates, followed by Micrococcus luteus (12%). Pathogenic species were also detected, including Staphylococcus aureus (6%), Enterococcus faecalis (15%), Escherichia coli (3%), and Klebsiella pneumoniae (3%), with butcheries yielding more pathogens. Heavy contamination (>1000 CFU) was observed on 16% of handles. Conclusion: Most door handles in this setting carried low-to-moderate bacterial loads, dominated by environmental and skin flora, though occasional pathogens were recovered. These findings emphasize the importance of routine disinfection of frequently touched surfaces and maintaining proper hand hygiene in community environments.

1. INTRODUCTION

High-touch environmental surfaces (HTES) are frequently touched by many people and can act as fomites for microbial transmission (Kramer et al., 2006; WHO, 2009) . Pathogens such as Staphylococcus aureus, Enterococcus spp., and enteric bacilli may survive on these surfaces for days to months (Neely and Maley, 2000; Wendt et al., 1998). Environmental conditions like heat, humidity, and sunlight strongly affect survival: high temperature and UV exposure usually reduce bacterial viability (Shimoda et al., 2019; Jabłońska-Trypuć et al., 2022). In contrast, Bacillus spp. and staphylococci are resistant to heat and sunlight and are often recovered (Nicholson et al., 2000).

Qasr Bin Ghashir is a district near Tripoli that contains many small shops and butcheries visited by local residents. Despite this, little is known about the bacterial burden of shop door handles in this setting. Several reports worldwide highlight microbial contamination of door handles in community and hospital settings. In Nigeria, door handles yielded staphylococci, enterococci, and Gram-negative bacilli (Edi et al., 2023; Ayuba et al., 2019). In Libya, surveys in Zawia hospitals and Tripoli NICU also documented bacterial recovery, mainly coagulase-negative staphylococci and diphtheroids (Health Canada, 2023; Xie et al., 2024). A systematic review concluded that door handles commonly harbor skin flora, but pathogens are sporadically present (Appiah et al., 2025). However, little is known about door handles in hot, sunny North African community environments outside hospitals. This study aimed to determine colony-forming unit (CFU) levels and bacterial profiles of external door handles from food shops and butcheries in a Libya-like setting. We hypothesized that most handles would carry low–moderate CFU dominated by skin and environmental flora, with occasional pathogens.

2. METHOD

Methods. We conducted a cross-sectional survey of 25 shops (15 food stores, 10 butcheries) in Qasr Bin Ghashir district, Tripoli, Libya. Door handles were swabbed with sterile saline-moistened swabs over ~25 cm². Sampling was done during sunny weather typical of the local climate. Samples were plated on Nutrient, Blood, and MacConkey agar and incubated at 37 °C for 24–48 h. Colony counts were classified into four categories: <10, 10–100, 101–1000, and >1000 CFU (Appiah et al., 2025). Bacteria were identified by morphology, Gram stain, catalase, coagulase, oxidase, and selected biochemical tests.

3. ETHIC APPROVAL

Sampling was conducted only after obtaining verbal permission from the shop owners, who were cooperative and aware of the study's purpose. No personal data were recorded, and only the shop type (food store or butchery) was noted. The study did not involve human or animal subjects.

4. RESULT

Among the 25 handles examined, 40% yielded 10–100 CFU, 32% had 101–1000, 16% had >1000, and 12% had <10. Bacillus spp. (35%) and coagulase-negative staphylococci (27%) were the most common. Micrococcus luteus (12%) was also frequent. Potential pathogens included Enterococcus faecalis (15%), Staphylococcus aureus (6%), Escherichia coli (3%), and Klebsiella pneumoniae (3%). Notably, two butcheries showed very heavy contamination (>1000 CFU) with mixed flora, suggesting poor cleaning practices.

Table 1. Distribution of CFU categories

CFU Category	N	%
<10	3	12.0
10–100	10	40.0
101–1000	8	32.0
>1000	4	16.0

Table 2. Frequency of bacterial isolates

Isolate	N	%
Coagulase-negative Staphylococci	9	26.5
Bacillus spp.	12	35.3
Micrococcus luteus	4	11.8
Staphylococcus aureus	2	5.9
Enterococcus faecalis	5	14.7
Escherichia coli	1	2.9
Klebsiella pneumoniae	1	2.9
Pseudomonas aeruginosa	0	0.0

Table 3. CFU categories by shop type

CFU Category	Food	Butchery	Total
<10	3	0	3
10–100	8	2	10
101–1000	2	6	8
>1000	2	2	4

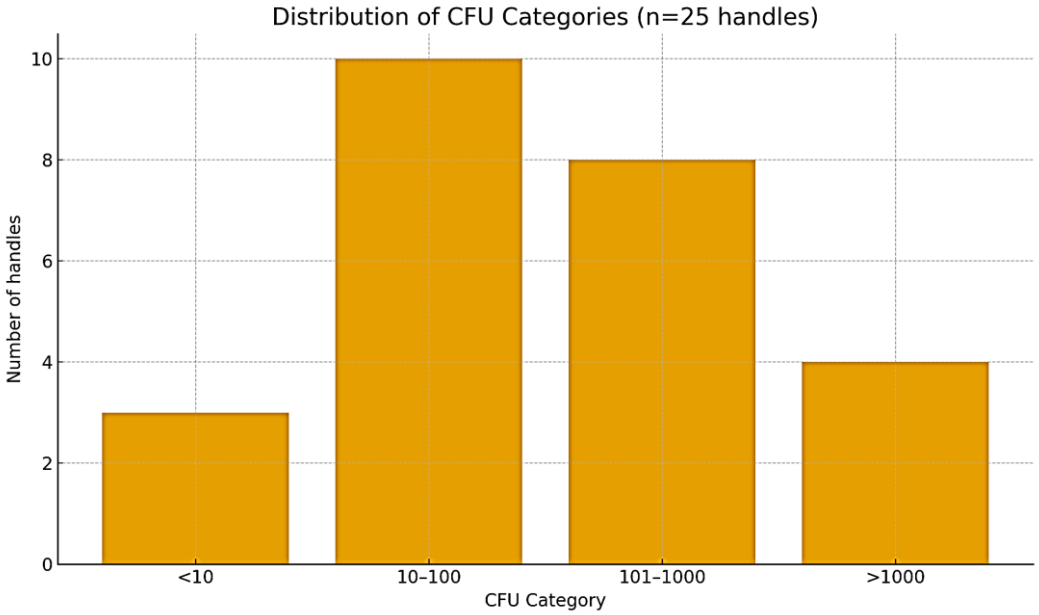


Figure 1. Distribution of CFU categories

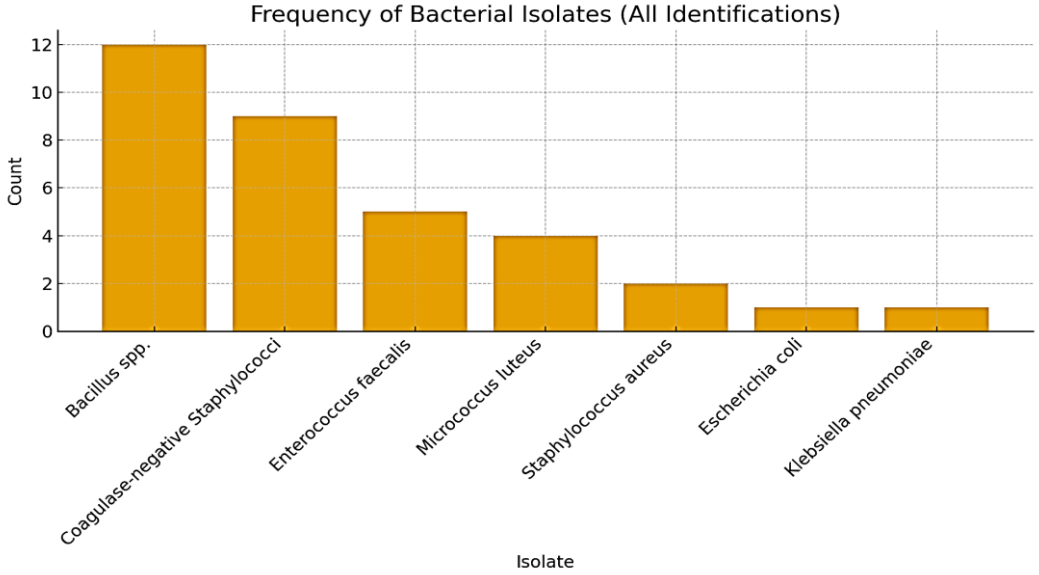
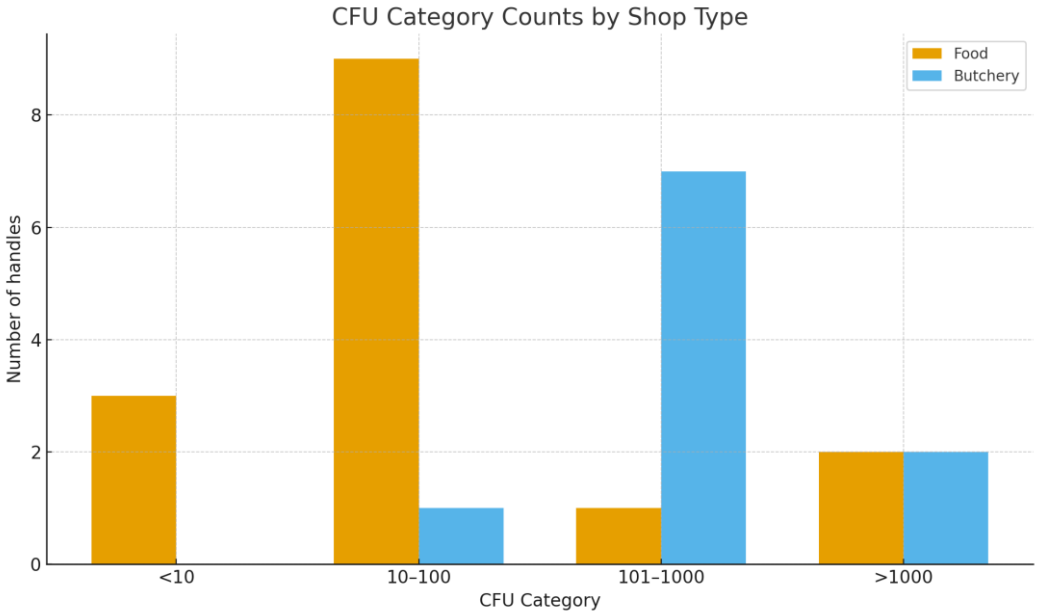


Figure 2. Frequency of bacterial isolates



. Figure 3. CFU categories by shop type

5. DISCUSSION

This survey confirms that external door handles in small shops harbor viable bacteria, mainly skin flora and environmental organisms (Edi et al., 2023; Appiah et al., 2025). Bacillus spp. predominated, reflecting their spore-forming ability and resistance to heat and sunlight (Shimoda et al., 2019). Coagulase-negative staphylococci and Micrococcus are typical skin commensals (Jabłońska-Trypuć et al., 2022). Recovery of Staphylococcus aureus and Enterococcus faecalis is notable, as both are clinically important and frequently reported on high-touch surfaces in community surveys (Edi et al., 2023; Ayuba et al., 2019). Enteric bacteria such as Escherichia coli and Klebsiella pneumoniae likely reflect fecal contamination or transfer from meat in butcheries (Kramer et al., 2006). These findings align with studies from Nigeria describing recovery of staphylococci, enterococci, and enteric bacilli from door handles (Edi et al., 2023; Ayuba et al., 2019). In Libya, Abougrara et al. also found coagulase-negative staphylococci and Gram-negative bacilli on hospital door handles (Abougrara et al., 2024). Overall, CFU levels in this community survey (mainly 10–100) were lower than many hospital studies, probably due to heat and sunlight reducing survival (Shimoda et al., 2019). In Qasr Bin Ghashir, many shops lack routine disinfection, which may explain the higher contamination in butcheries. Practical measures like cleaning handles with alcohol or hypochlorite, combined with public hand hygiene, can help reduce contamination (Feng et al., 2022).
Our findings are consistent with reports from Nigeria describing similar bacterial profiles on door handles (Ayuba et al., 2019). In Libya, Abougrara et al. documented coagulase-negative staphylococci and Gram-negative bacilli on hospital door handles (Abougrara et al., 2024), while Ashur et al. reported environmental contamination in the Tripoli NICU (Ashur et al., 2022). Alsharksi et al. further characterized bacterial profiles and antimicrobial resistance in ICUs of Misurata Central Hospital (Alsharksi et al., 2025). The overall CFU levels in our community samples (mainly 10–100) were lower than many hospital surveys, possibly due to sun exposure reducing survival (Jabłońska-Trypuć et al., 2022).
Public health implications include reinforcement of hand hygiene campaigns (WHO, 2010). Cleaning of high-touch community surfaces can reduce transient contamination (Feng et al., 2022; Querido et al., 2019). Our results highlight butcheries as higher-risk sites, consistent with literature noting contamination from animal products and persistence of enteric organisms on dry surfaces (Kramer et al., 2006; EFSA, 2023). Regular disinfection of handles using alcohol or hypochlorite, together with accessible hand rub for the public, are practical interventions (Feng et al., 2022; WHO, 2010).

Limitations

Limitations include modest sample size, reliance on conventional identification, and semi-quantitative CFU categories rather than absolute counts. Molecular typing and resistance profiling were not performed. Sampling was limited to one district and sunny weather. Nonetheless, results were consistent with global literature and provide baseline data for Libya-like settings .

6. CONCLUSION

This survey in Qasr Bin Ghashir shows that most shop door handles carried low to moderate bacterial loads, mainly harmless flora but occasionally pathogens. Simple measures such as routine cleaning and hand hygiene remain essential to reduce the risk of fomite transmission in the community.

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